Electrical Review

Vol. 79—No. 3. CHICAGO, SATURDAY, JULY 16, 1921. Page 77.

Power Development and Use in Middle West

Utilization of Low-Head Water Sites Near Load Centers to Carry Peaks—Steam Plants to Provide for Capacity in Excess of Available Water Power—Paper Before A. S. M. E. Convention

By C. W. PLACE

At present the sources of power for the supply of light, heat and energy for mechanical operations necessary for the life and continued development of the Middle West are coal, oil and gas-fired steam equipment, internal-combustion and heat engines, and water-driven equipment. Wind and solar heat sources do not cut much figure in considerations at present.

Fig. 2 is a map of the Middle West with the coal fields it draws from indicated. Fig. 3 is a map of the same section with the rivers and larger streams indicated. Fig. 4 is the power transportation system of Illinois only.

It may be noted from the illustrations that the coal fields are not located conveniently as regards water supply for condensing purposes, and not particularly convenient to the load concentrations as at present arranged. A recent news report indicates that the Federal investigators on power conditions of the Atlantic coast states have concluded that the answer was not in enormous production at the mines on account of condensing water conditions. On the basis of our conditions and economical production it looks as if every 100,000 kw. produced in a day would require 380,000,000 gals. of water, or a flow corresponding to 588 sec. ft. for condensing purposes. It would, therefore, seem that the Middle Western power can not be taken care of at the mines as we do not have the mines near streams of the proper size. The rivers and streams are in better relation to the load, as the cities and towns have grown up along these streams.

The production of power so far by steam has been practically always at the load concentration. A start has been made transmitting from steam stations to less heavy load centers. A moving of load to cheap power has been successful in a

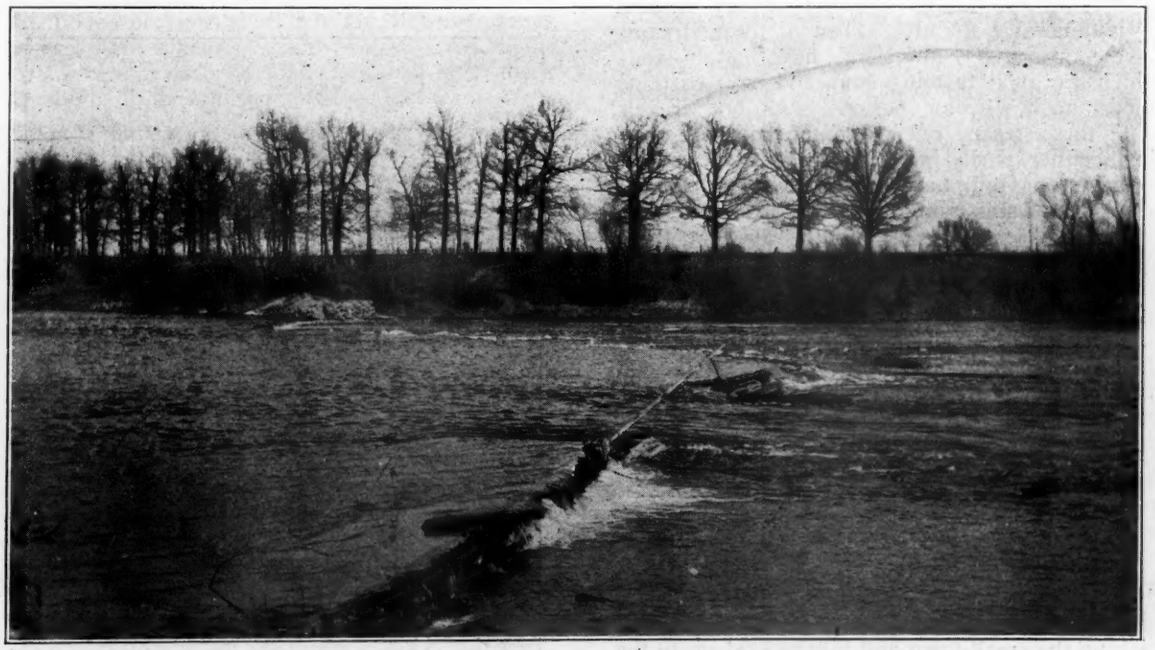


Fig. 1—Abandoned Power Site Suitable for Redevelopment as Part of a General and Comprehensive Plan.

number of cases, but this has caused unnatural conditions in other respects and has not necessarily been for the greatest good of the country as a whole. We have no great sources of hydraulic power conveniently available which can

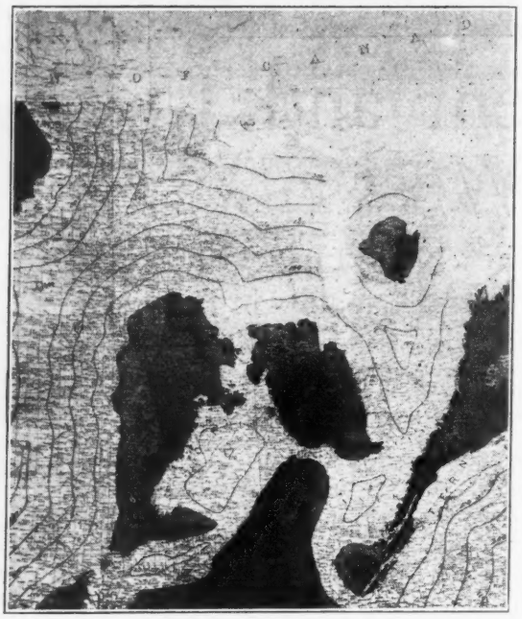


Fig. 2—Map of Middle West, Showing Sources of Fuel Supply.

be profitably developed at present money rates and material costs. We must, therefore, lay our plans on our real conditions; not on some imaginary combination as regards power supply, or regrouping the load arrangement.

Large blocks of power have been developed at centers of load by large steam stations. These large centers are, however, not close together, but each has its tributary country with low load density. This territory is made up of towns and villages surrounded by farming country drained by innumerable streams. Most of these streams have comparatively low banks, have bottom lands which are good farming land, and have extreme flood and low-water periods. As one travels along these streams one sees any number of small dams either partly washed out or still serving to drive some mill, making a more or less efficient use of the water going down the stream. From personal observations I should say that these streams would be able to supply the necessary power for all the towns and villages near them up to towns of 25,000; that during a good part of the year they could assist even in these towns during the peak if properly connected and manipulated. In these 14 central states there are but 102 cities of over 25,000 people. Cities of this size have already established quite efficient steam plants.

Plan to Join Together a Large Number of Small Plants.

Now, suppose that the power houses of all these 102 cities were connected together, not by heavy high-voltage lines, but by lines which would pick up the small-town and village load up to the point where its next large neighbor would take its share, and that streams near these towns and villages had hydroelectric stations of a size proportionate to the size of the stream. These 102 steam stations must work on a fair load to get their best efficiency, both from a steam-economy and a maintenance basis, and when the units are operating at good efficiency a sudden increase in load cannot be handled properly until other units are brought on and steam conditions have been restored. During this period of adjustment the voltage goes down and the frequency drops, and would drop more if the voltage were brought back to normal. Due to these conditions extra machines are now carried either under part load or ready to put into service at once.

Each Station Has a Small Pondage.

Suppose the interconnection mentioned above has now been made, and a goodly number of these hydraulic stations installed. These hydraulic stations are large enough to take a little more than the average stream flow; that is, they are over developed. Each has a small pondage and is automatically controlled so that it will come into service on a drop of frequency of the system and in sequence with other plants, depending on the proportion of its working head available at the instant. That is, the plant with the best water condition will get on the line the quickest and it will drop off the line on a decrease of its water supply or a dropping off of load. It will be assumed that the steam stations are operating efficiently and have a sudden increase in load. Also, these various hydraulic stations are operating, using up the natural stream flow, and sending but a very small proportion of their load toward the city. With the drop in frequency the several waterwheel generators installed for the flow above the average begin to come in and to draw on the ponds. Enough machines will come in to bring the frequency back to normal. In the meantime the steam stations are brought back to normal. The operators have not let the voltage stay down to save the speed, but have restored

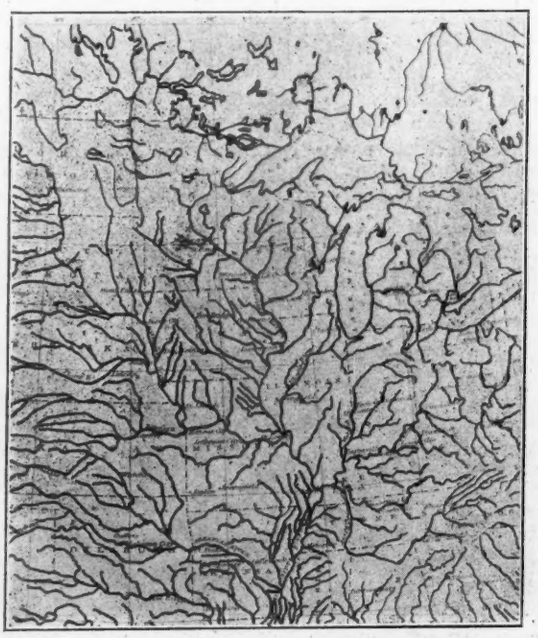


Fig. 3—Rivers of Middle West, Showing Their General Distribution.

it at once and the service has been maintained. With this automatically started reserve there is an opportunity to decide whether the load is going to continue, and, if so, to get on extra boilers and machines. It is known that the hydraulic helpers are going to begin to drop out as they exhaust their pondage, so the steam operation can be governed accordingly.

Extra Pondage Provided Wherever Conditions Favor.

Now, suppose each of these streams had the low swampy ground and the willow thickets made into ponds, even where there was insufficient head for power development, which could release when the ponds with hydroelectric stations were drawn down by this sudden drain. This would mean perfect flood control for normal rises, and by holding out steam stations very good control during extreme floods.

These smaller streams lead to the larger rivers, and with an approach at flood control on the tributaries there would be a greater number of larger scale along these larger rivers, each to be controlled in the same way. Each development would help the flood conditions below and make feasible developments not now economically practical.

Very closely resembling this hypothetical case is the arrangement for taking care of the peak load of New York City, where F. O. Blackwell suggested that water if pumped up to an area on the Palisades during the off-peak period and allowed to come down during the peak would develop the peak power more economically than by any other method of reserve. He states that this is being done in several installations in Switzerland, pumping the water into reservoirs when the load is light. Prof. R. A. Fessenden suggested that such storage be made underground, the hole being dug near the load.

Our conditions do not perhaps lend themselves to this arrangement as readily as the combination mentioned previously. There are, however, cases where these schemes would probably work out. Along certain parts of the Mississippi river there are high bluffs, and in some places the land is not particularly good on top of the bluff. A transmission line along the bluff might get the reserve capacity in this manner if at the same time the pondage could act as a reserve reservoir for city filter beds or some such purpose. There are high valleys in the Ozarks where they have no natural large water supply, and where the land is of little value, which could act as reserve along this line if properly arranged, and if in conjunction with the natural water-power supply in the same region. This might even make some of the powers with greatest water fluctuations economically feasible.

We have quite a large reserve in Lake Michigan. On the way to Lockport there are large areas of worked-out stone pits and ground where it might be possible to get short-time storage so that the drainage canal could be called upon for such peak service without unduly drawing down the water level. Excess capacity would have to be installed at Lockport. The State deep-waterway project could be overdeveloped and operate along this line if properly connected and managed.

All this sounds highly imaginary, but Fig. 5 shows a map of a system where this is being done on a small scale with manually operated and automatic stations, except that as yet there is

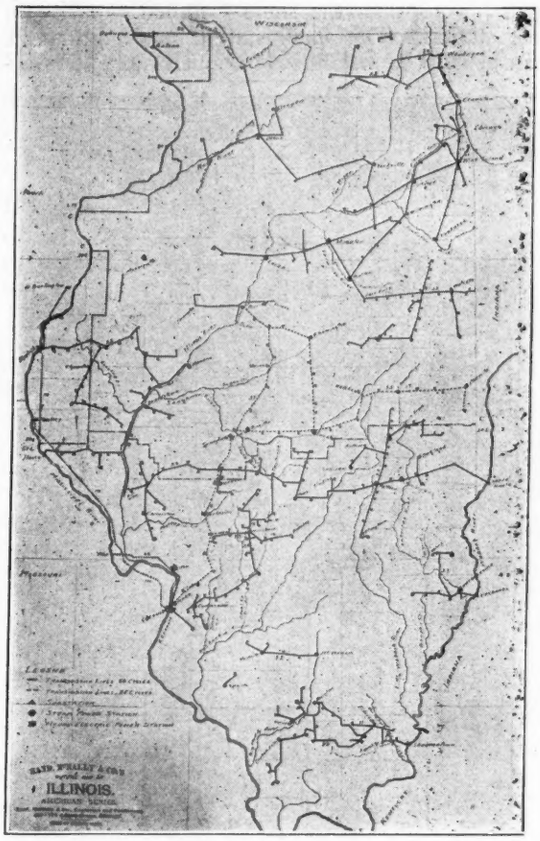


Fig. 4—Map of Illinois, Showing Power Plants and Transmission Lines.

no steam reserve. This system is being extended by the addition of more stations, and from present indications the entire river will soon have increasingly larger stations installed. As you descend the river the dam of each new plant is located at the point where the ordinary back water from the dam below runs out. Other systems are doing something along this line.

Use of Pond Capacity Depends Upon Character of Load.

Suppose this idea were carried to its ultimate conclusion. The method of operation would be changed from the present; then the steam station would carry the steady continuous load above the minimum stream flow, the hydraulic equipment would carry the peaks, and on off-peak periods they could restore the pondage and carry local load. The quickness with which the hydraulic stations can get on the line—12 to 30 sec.—will allow the steam stations to always work at maximum efficiency.

All of these developments must be made at a cost to show a reasonable profit. In order to arrive at the correct profit, however, all the advantages must be weighed. A small automatic station tied to the line has a stabilizing effect on voltage which would be worth something. It should receive a credit equivalent to transmission losses, it should receive a credit on the basis of

the investment in coal storage of the steam station which it relieves, and it should receive some credit from the labor angle.

A multitude of these small stations will, by means of legitimate interconnections, do more actual work than the same installed capacity in one station. The small station made automatic can usually be installed on a much more satisfactory basis than the large installation, and it can usually be financed locally. A good share of the money will remain near the site, and a large amount of land will not be taken out of production so there will not be a large overhead. The land which is taken will be of small value.

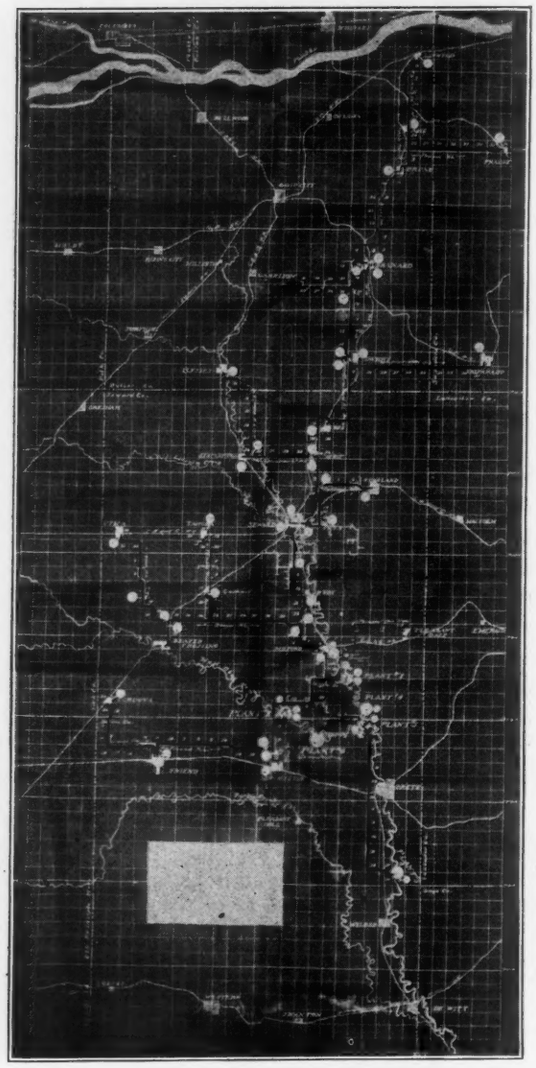


Fig. 5—Local System Wherein Various Plants Work Together.

If the development is forced beyond a certain point under Middle Western conditions this land becomes the most valuable corn land we have; i.e., the second bottom land. The dam which before was an easy proposition on a more or less soft bottom now becomes a difficult proposition, and the development will not show a profit. It therefore is necessary to multiply the number of stations instead of increasing the size if we wish to get total capacity. If these smaller stations are first installed it would seem that the larger streams could be used if developed on the same general plan, and money made by the development.

Now, what are the things that we should do? First, the stream conditions and their possibilities should be studied with this or some similar object in view. Second, public opinion should be influenced in the proper direction so as not to obstruct such development. Third, rivers which are technically navigable, but are not really so, should either be released or made navigable and the flow used for power development. Fourth, in the permanent highway improvement campaign, influence should be used to have these permanent highways miss sites for future development or their natural ponds. Fifth, the relative importance of railway transportation and power development may change, so any readjustments of railway road beds up river valleys should be along the lines not to interfere with the possible stream development. It may easily prove that the railway may be the first and most important benefactor in its electrification. Public sentiment might easily assist in this. Sixth, existing power sites in the form of mill dams should be developed and tied into the nearest transmission, and the possibilities along this line should be investigated and gotten under way in every locality. Seventh, the investing public should be instructed along the lines of developments in their vicinity. That our water power possibilities are not gold mines for the owners, are of little value if not tied in with existing systems, and when they are so tied in increase the value of the system and make its securities a better investment proposition, should be emphasized.

SYNCHRONOUS CONDENSERS USED ON TRANSMISSION LINES.

Long high-voltage lines cannot be efficiently operated without synchronous condensers at the receiving station to regulate the voltage. As a consequence the charging current, even at the standard 60-cycle frequency, becomes a factor of no great importance as long as these synchronous condensers are connected to the line. Without them the line charging current must be furnished entirely by the generators, in which case the generators may become greatly overloaded and at the same time produce a very high voltage over which the operator has no control. To avoid this emergency a transmission line with its generators, transformers and synchronous condenser must be considered as a unit and as such should be securely coupled together electrically at all times.

CONCESSION FOR ELECTRIC TRANSMISSION LINE IN CHILE.

A decree has been published in the Diario Oficial to the effect that the Compania General de Electricidad Industrial, a Chilean firm, had been authorized to construct a transmission line for the distribution of electricity between Rancagua and Paine. In return for certain facilities specified in the provisions of the decree, the company is required to furnish electricity to the government offices at a discount of 25%. The length of the line is about 25 mi.

Never mind the price; what is it worth to you?

Selection of Feed Water Heaters for Power Plants

Economy Depends Upon Quantity of Heat Recovered From Waste Sources—Relative Merits of Open and Closed Heaters—Heated Feed Water Reduces Strains and Increases Boiler Output

By ROBERT JUNE

What does a feed water heater accomplish? If I have not a feed water heater in my plant would it be profitable to install one? These are questions the answer to which is of considerable interest to the manager or superintendent of a factory producing its own power.

As its name implies the feed water heater is an apparatus for increasing the temperature of the feed water before it is pumped into the boiler. Generally speaking, for every 11 to 12 deg. F. the feed water is heated there is a gain of 1% and a corresponding saving of coal, provided the heat which warms the feed water would otherwise be wasted. The fuel saving effected by preheating feed water is shown in Table I. It will be noted that the savings effected range from 1 to 15%, with 7 to 12% as the most probable amounts to be effected in practice. The table has been worked for a boiler pressure of 1 lb. as well as for a pressure of 200 lbs., and it will be seen that the boiler pressure is a factor of practically no importance in the matter, inasmuch as there is only a difference of 0.5%, or less, in savings with 1 lb. pressure as compared with 200 lbs.

Increased Boiler Capacity Resulting From Use of Feed Water Heater.

The heater does part of the boiler's work. With the same quantity of coal burned a considerable increase of boiler output is assured by heating the feed water, since the latter enters the boiler with a part of its heat supplied. A greater evaporation will take place with the same amount of heat transmitted through the boiler heating surface. Thus, for example, with an initial temperature of 60 deg. F., and a boiler pressure of 120 lbs., the total heat that must be supplied is 1163.6 B.t.u. per lb. of water. If, however, the feed water temperature is raised to 210 deg. F., which is an increase of 150 deg., we find that only 1013.6 B.t.u. per lb. of water is required. This is a difference of 150 B.t.u., which is equivalent to 13 or 14% increase in capacity of the boiler with the same amount of fuel.

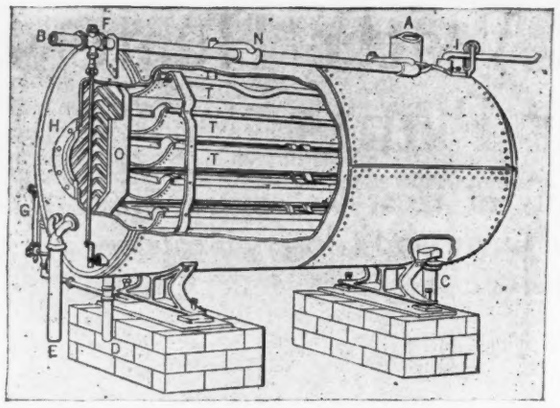
The feed water heater reduces boiler strains and damage to boiler plates. When cold feed water is precipitated into the boiler sudden violent strains are almost sure to occur. When the cold water strikes the hot plates the rivets may become loosened and, as the strains are local, the plates and tubes may be directly injured as well as the joints become loosened. It is almost axiomatic that good and long service cannot be had from any boiler supplied with cold feed water. The advantages of relieving boilers of the violent strains caused by the admission of cold water are not measurable by the saving in wear and tear, but are nevertheless very marked.

Efficient and inefficient engines have one characteristic in common; that is, that neither abstracts any large amount of heat from the steam. This is an important point to remember in connection with the possible use of a feed water heater, and it is a point directly connected with the choice of an engine and the decision as to whether it shall operate condensing or noncondensing. The answer depends upon what use can be made of the exhaust steam. Thus, if we can use exhaust steam for heating purposes, for drying materials, or in the various plant processes, the steam economy of the engine may not be important, but in preference to installing an expensive and elaborate condensing engine we may find it better economy to put in a low-priced noncondensing engine using 30 to 40 lbs. of steam per hp-hr. and to utilize a part of the exhaust steam for the purpose of preheating feed water.

Feed water heaters are generally placed in one of the following two classifications: (1) *Open heaters* are heaters in which steam and feed water mingle and the condensing steam gives up its heat directly to the water. (2) *Closed heaters* are heaters in which the steam and water are in separate chambers and the steam gives up its heat to the water by conduction. To further classify heaters they are sometimes separated according to the pressure of the heating steam, as (*a*) vacuum or primary heaters, (*b*) atmospheric or secondary heaters, and (*c*) pressure heaters.

In vacuum or primary heaters the pressure is less than atmospheric. These are the heaters using the exhaust from condensing engines and they are always of the closed type. In atmospheric heaters the pressure is atmospheric; or the

National Open Feed Water Heater.



Hoppes Horizontal Feed Water Heater.

pressure corresponds to the back pressure on the engine and pumps. In pressure heaters the pressure corresponds to that in the boiler. These heaters are used primarily for purifying purposes. Among well-known heaters of the atmospheric type are the Cochrane, Hoppes, Stillwell, Webster, Elliott and National. Among well-known heaters of the closed type are Wainwright, Wheeler, Otis, National, etc.

Essential Requirements of Feed Water Heaters.

The chief objection to the use of the open heater is that the oil in the exhaust steam may reach the boiler; but when the oil separator really takes out the oil a most serious objection is removed. Therefore, the open heater should have an effective oil separator large enough to form a part of the heater, and it should be so designed as to eliminate all the oil before the exhaust steam enters the heater. It is not commercially practical to remove the oil or emulsion from water, and the filter bed should never be depended upon for this work. To operate satisfactorily the oil separator should have part areas of ample size and unrestricted passage. It should be self-cleaning.

The water carrying capacity of the heater should be large; in fact, this is what really determines the rating of an open heater. Best results in purifying are assured with a large volume of water, and when there is an ample supply the fluctuations in demand for feed water will cause no trouble and the boiler feed pumps will run smoothly. There should be at least a 5-min. supply in the feed water heater although, of course, local conditions may alter this amount. The purifying of feed water in an open heater demands that the construction allow an easy facility for cleaning. The interior should be accessible without disturbing piping conditions, and it should be possible to renew filter material without breaking a single connection.

The Cochrane, shown in an accompanying illustration, is a typical example of an open heater. Exhaust steam enters the heater through a fluted oil separator, as indicated, and passes out through the top, while the oil drips are automatically drained to waste by a suitable float. The feed water enters through an automatic valve and is divided over a series of copper trays so arranged and constructed that the water is forced to fall in a finely divided stream before reaching the reservoir in the bottom. The steam, coming into contact with the water particles, gives up latent heat and condenses. Some of the scale-forming element is deposited on the surface of the trays from which it may be removed. The suspended matter is eliminated by a coke filter in the bottom of the chamber, and the floating impurities are decanted by a skimmer or overflow weir. The particular heater shown in the illustration is especially designed for use in a steam heating plant. Besides performing all the functions of an open heater it provides for the reception and heating of the condensation returned to it from the heating system.

Another illustration shows a section through a Hoppes open heater, illustrating the "Pan" type of equipment. Exhaust steam enters at *H*, passes through the oil filter, and completely surrounds pans *TT*. The feed water enters at *B*, the rate of flow being regulated by the valve *F* which is controlled by a suitable float in the lower part of the chamber. The water in flowing over the sides and bottom of the pans comes in direct contact with the steam. The National heater, shown in another illustration, has an oil separator of the same diameter as a shell of the heater and forming its back head.

There is very little of special moment which can be said with regard to the performance or economy of any particular make of feed water heater as compared with the others. Any open-type feed water heater in which the size of the openings are properly designed to admit steam and water, and to discharge water, and which has a proper arrangement of perforated trays for breaking up the water for close admixture with the steam, will utilize all of the exhaust steam possible and will increase the temperature of the entering water to a temperature within 2 to 5 deg. F. of the temperature of the steam which is used for heating the water.

Other Economies From Use of Feed Water Heaters.

There are other possible economies to be obtained from the use of a feed water heater; such, for instance, as the retaining of solids made insoluble at the temperatures of the hot water within the heater, rather than to let those solids go on to the boiler. There are various constructions on the market for which it is claimed that a large quantity of such solids will be retained in the heater, but the largest part of these solids cannot be retained on the heating trays or in the filter section of any of the so-called standard types of heaters. It is necessary to provide a water storage capacity of such volume that the heated water may remain practically motionless for a period of 0.5 hr. to 1 hr. before any real depositing action will be obtained in the feed water heater. Such a construction means a tremendous use of valuable floor space or head room in the power plant for the installation of such a storage compartment and is usually not considered economical practice except where the water conditions are unusually bad.

What of the closed heater? The essential requirements of the closed heater are as follows: (1) That they may be easily and thoroughly cleaned; (2) heat the feed water to the boiling point without causing any back pressure; (3) not foul with scale if properly cared for; (4) separate and carry off the water of condensation from

waste; (5) extract the oil from the exhaust so that the steam can be used for heating purposes and the condensation from the heat coils be returned to the boilers without injuring them; (6) collect and carry off any scum on the surface of the water; (7) be so constructed that any individual tube can contract and expand independently of the others, and (8) they should be made of the best materials and be thoroughly tested before leaving the factory.

The body of the Wainwright heater is made of cast iron, and the tubes are made of corrugated copper. The water passes through the tubes and the steam surrounds them. The feed water and exhaust steam do not mingle, and hence the oil in the exhaust does not contaminate the water. Water chambers are divided into several compartments, as shown in the illustration, and the partitions are so arranged that the flow of feed water is directed back and forth through various groups of tubes in succession. This arrangement gives a higher velocity of flow than in the nonreturn type of heaters and therefore increases the rate of heat absorption. The mud and impurities settle at the bottom and are discharged through the mud blow-off, and such impurities as rise to the surface are removed by the surface blow-off. The tubes are corrugated to allow for expansion and at the same time increase the area for transmission of heat.

In the National closed heater, which is not illustrated, efficiency in heat transmission is secured by the use of a small curved or coiled tube. Even distribution of the water to the tubes is secured by large manifolds or tube chambers into which the ends of the tube coils are expanded. The tube ends are accessible through their plugged holes on the top of the tube chambers in the large heaters.

One of the most common experiences in connection with the operation of closed heaters is to find them leaking water from the bolted flange joints. Upon inquiry in such cases one is invariably informed that it is not always an easy matter to pack the flange, it being a job that must frequently be done on Sunday or at night. In nearly all cases it will be found that the leakage is due to the fact that there is no relief valve to take care of the increased water pressure caused by heat and expansion when the feed water valves are closed. It has been found that the pressure of the water when the feed water valves are closed will at times reach a pressure of 500 lbs. In such circumstances the importance of the relief valve can be readily appreciated, and it will be found that the use of such a valve will remedy the cause of closed heater leakage.

Comparative Characteristics of Open and Closed Heaters.

Which shall it be—the open or the closed heater? Each type has its advantages, and heaters of both types are made by a number of concerns. A careful study of the particular plant conditions for an intelligent choice is necessary. The following parallel comparison brings out a few of the important factors:

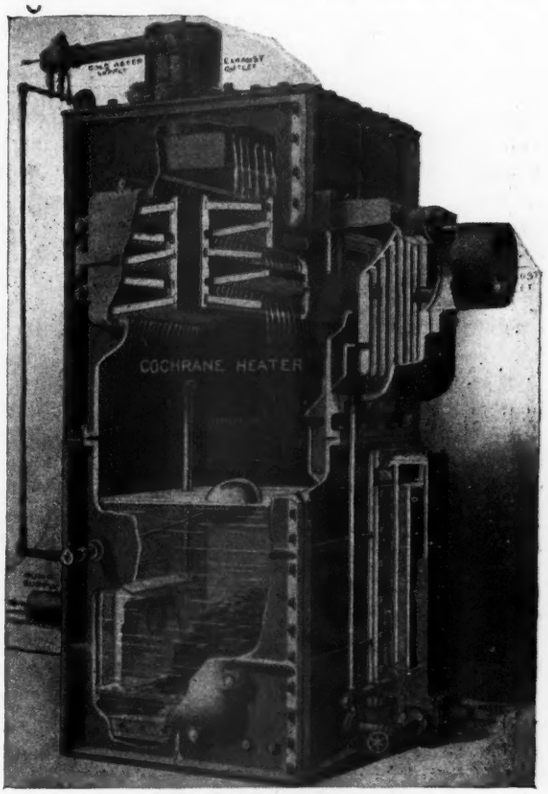
Efficiency.—*Open heaters:* Feed water may be brought to the same temperature as the steam by employment of sufficient exhaust steam. *Closed heaters:* Feed water will always be 2 deg. F. or more lower than the temperature of the steam.

Scale and Oil.—*Open heaters:* Do not affect the heat transmission. *Closed heaters:* Will lower the heat transmission.

Pressure.—*Open heaters:* Seldom subjected to more than atmospheric pressure. *Closed heaters:* Water pressure slightly exceeds that in the boiler, as it is customary to place closed heaters on pressure side of the pump.

Safety.—*Open heaters:* Sticking of the back-pressure valve may cause the open heater to fail if provision for relief is not made. *Closed heaters:* Will safely withstand any pressure likely to occur.

Purification.—*Open heaters:* Oil in exhaust steam comes in contact with feed water and must



Cochrane Open Feed Water Heater.

be removed. *Closed heaters:* No oil comes in contact with feed water.

Removal of Precipitate.—*Open heaters:* Scale and other precipitate is readily removed. *Closed heaters:* Scale and precipitate is removed with difficulty.

Location.—*Open heaters:* Must always be placed before the pump suction on the suction side. *Closed heaters:* May be placed anywhere on the pressure side of the pump.

Pump.—*Open heaters:* With supply under suction, two pumps are necessary and one must handle hot water. *Closed heaters:* One cold-water pump necessary.

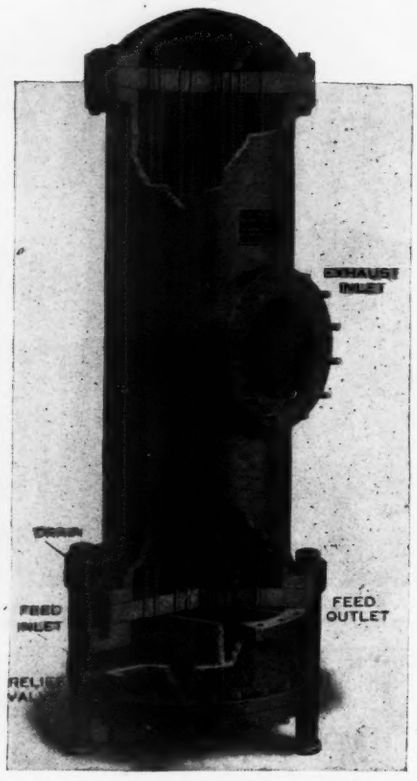
A further advantage for the open heater claimed by manufacturers of this type of equipment is that there is a marked saving in water. Thus, in the open heater 6 lbs. of water and 1 lb. of steam combine to make 7 lbs. of feed water, but in the closed heater there is no mingling of the steam and water; consequently 7 lbs. of water and 1.06 lbs. of steam are required to produce the result. That is to say, the closed heater uses 14%

more water than the open heater. This point may be important in some plants, but of no moment in

TABLE NO. 1—FUEL SAVING EFFECTED BY PREHEATING FEED WATER.

Temperature increased, deg. F.		Savings boiler pressure,	
		1 lb.	200 lbs.
From	To	%	%
40	212	14.79	14.28
50	212	14.08	13.60
60	212	13.35	12.75
70	212	12.60	12.04
80	212	11.83	11.31
90	212	10.92	10.56
100	212	10.12	9.68
110	212	9.32	8.92
120	212	8.46	8.10
130	212	7.60	7.28
140	212	6.72	6.44
150	212	5.82	5.58
160	212	4.90	4.65
170	212	3.96	3.76
180	212	3.00	2.85
190	212	2.02	1.95
200	212	1.02	0.97

others. Finally, the thing to be emphasized in connection with the prospective purchase of heaters is, first, that such equipment makes for eco-



Wainwright Closed Feed Water Heater.

nomical operation, and second, that the proper choice of the heaters will depend upon individual conditions.

SERVICE CERTIFICATES AWARDED BY WESTERN ELECTRIC CO.

The Western Electric Co. now is distributing special service certificates to more than 16,000 of its workers who have seen two or more years in its employ. The certificates, like the gold and silver stripes of the war-time days, afford visible testimony of faithful and steady service in one of the world's great industries. They assure the workers of full protection under the generous insurance and pension provisions of the Employes' Benefit Fund maintained by the company. When it comes to comparing the growth of industrial families of America, the Western Electric Co. holds an enviable record. It has grown from a small shop of five men in Cleveland in 1869, to an international organization of more than 38,000 people. More than 16,000 of its present employes have been with the organization longer than 2 yrs.

The five most venerable veterans of the company are at its great telephone manufacturing plant near Chicago. All of them are shop workers. They show an aggregate service of 205 yrs. with the company. George E. Perlewitz, the dean of the quintet, with 43 yrs. service, joined the electrical industry when it was still in its infancy in 1878. Fred W. Loehr was with the Western Union Co. for 2 yrs. before its shops were taken over by the Western Electric. His record of employment has run 42 yrs. The other members of the venerable five are William Miller, T. De Rusha, and M. A. Lund. Each of them can show two score years in the harness.

H. B. Thayer, president of the American Telephone & Telegraph Co., grew up in the Western Electric Co. Forty years ago, immediately after his graduation from Dartmouth he joined its ranks as a $10 a week clerk. He remained for 38 yrs., of which the last 10 saw him the company's president. Today he is chairman of its board of directors. Albert L. Salt, now a vice-president in charge of purchasing and traffic, started as an office boy in 1881. He celebrates his 40th anniversary as a worker this month. Beside these old timers the institution boasts 22 other employes who have continuous service of more than 35 yrs. each, 65 with more than 30 yrs., and 226 who have passed a quarter of a century in its ranks.

The total number of employes with service records of 10 yrs. or more is 4262. The 5 to 10-year class has 4282 members. The youngest class of benefit fund members are those with 2 to 5 years service to their credit, 7622 workers falling within this category. If the 16,000 certificate holders could combine their terms of service the result would go well over the 100,000-yr. mark. The long-established policy of the Western Electric Co. of filling its higher positions by promotions from within its own ranks is one of the main reasons for the many veterans it possesses.

BRITISH TAKING BIG AMOUNT OF BELGIAN COAL.

The Belgian coal trade continues to benefit by heavy British purchases, according to a report from Antwerp. On June 1 wages were reduced (for the third time since the armistice) by 5% and prices for industrial coal by the same percentage. Household fuel remains at its old price. Occasional "sympathetic" strikes which have started in certain pits have been severely condemned by the Liége Mineworkers' Association, which has issued a statement that these outbreaks are contrary to its counsel and are due to instructions from Moscow. All the miners, save those of Ougrée-Marihaye, where the strike arose from local causes, have been advised—and have agreed—to return to work.

Power Transformers for Extra-High Voltage

Precautions Required to Provide for and Guard Against Strains Due to Short-Circuit—Tapered Insulation and Arrangement of Windings Reduces Size of Finished Unit and Adds to Safety

By J. F. PETERS

Electrical Engineer, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Progress in the electrical industries in the past few years has produced a need for the transmission of large amounts of power over great distances. In order to meet this requirement power companies have been increasing transmission voltages until today a number of companies are considering the use of 220,000-volt lines, and two companies have already placed orders for apparatus to operate at this voltage.

Some factors that are of no consequence at low voltages, but easily provided for at 100,000 volts, become dominant at voltages of 200,000 and higher. Two of these factors are charging currents of lines and line insulators. The line insulator problem it is believed can be met, and the charging current can be supplied by synchronous condensers provided the lines are approximately electrostatically balanced. It is not possible, however, to produce satisfactory operation, even temporarily, with an electrostatic unbalance that is produced when one line of an isolated system becomes grounded. To avoid this condition, and also to prevent the lines from taking on a voltage greater than normal, it is considered advisable to ground the neutral of the system directly and permanently. This grounding is accomplished by connecting both the step-up and step-down transformers in "star" relation and grounding their neutrals.

Large Transformers Most Economical on High Voltage.

The transmission of large blocks of power at high voltage has also called for large transformer units. Large blocks of power could be handled with a large number of smaller transformer units, but small units cannot be economically built for high voltage since the space required for insulation is as great for small units as it is for large units. Therefore, in order to keep the percentage of space occupied by insulation within reasonable bounds, and thereby obtain good performance and reasonable cost per kv-a., the units must be large in rating.

Grounding the neutral of a star-connected bank of transformers puts one end of the transformer high-voltage winding at ground potential. By taking advantage of this feature and reducing the insulation gradually toward that end, making it practically zero at the grounded end, considerable improvement can be obtained in cost, dimensions and performances. In carrying out the grading or tapering of the insulation care must be taken not to upset the symmetry of the design. Transformers, especially large units, should be symmetrical with respect to primary and secondary windings, and with respect to the sizes of coil groups, in order to keep short-circuit stresses within reasonable limits.

Short-circuit forces are approximately proportional to the short-circuit kv-a. in the largest coil group of the unit, therefore, the larger the unit the higher in general will be the forces. These forces and the mechanical stresses which they create are present during short-circuit in all transformers irrespective of the type. In the shell type of construction the windings are divided up into groups so as to keep the kv-a. per group comparatively small, which results in correspondingly small mechanical forces under short-circuit. The problem of bracing the coils against the short-circuit forces of shell-type transformers is easily taken care of. Higher voltage service does not introduce any difficulties in coil bracing, in fact, the problem generally is easier than it is for lower voltage units.

The windings in core-type transformers for high-voltage service cannot well be split up into more than two groups for single-phase units or one group per phase for 3-phase units. Consequently the kv-a. per group in large units is large, resulting in comparatively large short-circuit

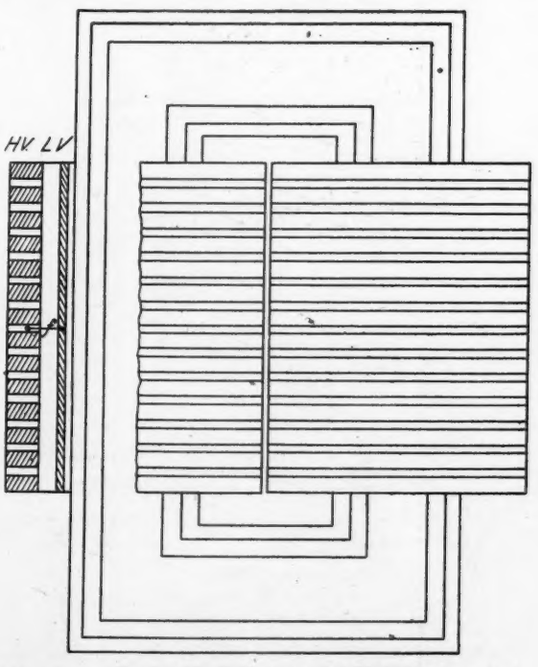


Fig. 1.—Diagram Showing Perfectly Centered Coils, Requiring No Bracing.

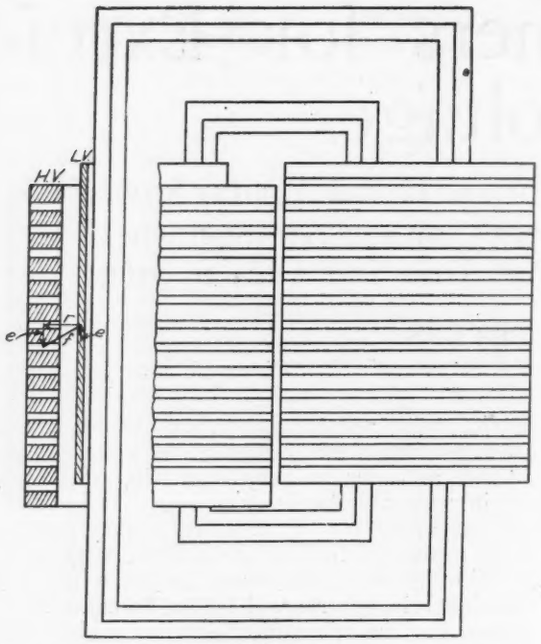


Fig. 2.—Diagram Showing Coils as Usually Actually Installed, Requiring Bracing.

forces. If the coils are magnetically centered, as indicated in Fig. 1, the short-circuit forces are radial and require no additional bracing. The tensile strength of the copper in the outer coils and the resistance to compression of the inner coils are, in general, sufficient to withstand these forces. However, the normal variations in dimensions of coils and insulation cause the magnetic centers to deviate from the exact centers. The forces then are in the directions indicated in Fig. 2, where f is the total force, r the radial force and e the end thrust. The end thrust must be taken care of by some means of bracing. The factor that causes the greater part of the shifting of magnetic centers in the usual core-type construction is the variation of dimensions in the large insulating supports at top and bottom of the high-voltage coil stack. This variation increases with increase of voltage, since the supports must be larger to take care of the greater voltage strains.

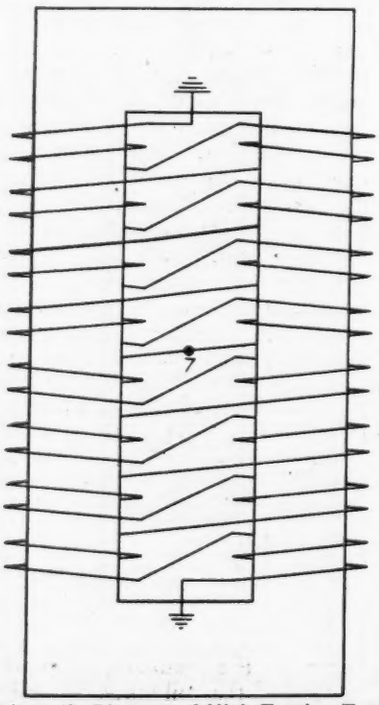


Fig. 3.—Schematic Diagram of High Tension Transformer Winding.

Two Taps Required for Intermediate Voltage to Avoid Strains.

In providing taps for different voltage ratios it is necessary to bring out two taps for each voltage in order not to shift the magnetic centers sufficiently to produce prohibitively large end thrusts during short-circuit. Transformers for high voltage are always immersed in oil which serves both as insulation and as a cooling medium. It is, therefore, necessary to provide ducts in the windings through which the oil will circulate. Shell-type transformers, as the term implies, have the laminated core around the windings and

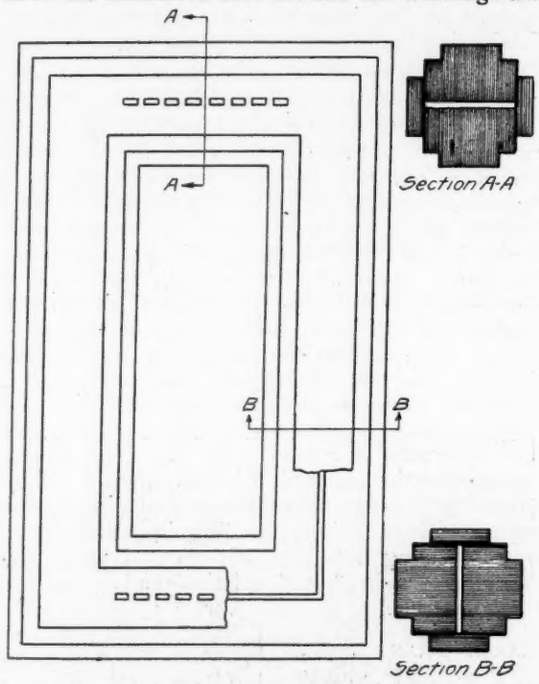


Fig. 4.—Transformer Core, Showing Oil Duct Through Center.

therefore there is a large iron surface exposed to the cooling oil, which keeps the core at a safe operating temperature without providing ducts in the core. The winding or coils stand vertically through the core with the top and bottom ends extending beyond the core. All oil ducts through the winding are therefore vertical and the addition of more insulation for higher voltage does not in any way interfere with the free circulation of oil.

In the core-type construction the windings are around the core, resulting in a relatively small exposed iron surface and making it necessary on large units to provide oil ducts in the core. The windings—particularly the high-voltage windings—are generally made up of circular pancake coils and therefore the oil ducts between them are horizontal, that is, they are at right angles to the natural circulation of oil. The heat generated by the transformer losses is removed by local oil eddy currents in the ducts between

coils, which convey the heat to vertical ducts at the edges of the coils. It is necessary to keep the radial depth of pancake coils small in order not to have local "hot spots" in the winding. The vertical duct between the inner edges of the high-voltage coils and insulating barrier between high- and low-voltages coils must be liberal in dimensions and free from obstructions in order that the heat discharged into it can be carried away by a free circulation of oil.

Transformer With Symmetrical Design and Tapered Insulation.

The Westinghouse company during the year 1920 built a transformer that is quite different from the ordinary core-type construction and is particularly well adapted for very-high-voltage units for operation on systems having solidly grounded neutrals. The design is entirely symmetrical and takes full advantage of the tapered or graded voltage feature. A transformer of this design is shown in accompanying illustrations. It is a 16,667-kv-a., single-phase, 60-cycle unit built for 220,000-volt, grounded-neutral service. Seven similar units are under construction for the Pacific Gas & Electric Co. for its Pit river development. The cores and yokes are of double cruciform shape, so as to fit circular coils. The coils and yokes have ducts or chimneys in their centers which, along with the outer surface, keeps the iron well within a safe operating temperature. These central ducts are so arranged that they do not weaken the mechanical strength of the core. Their arrangement is shown in an accompanying diagram. The narrow outer punchings bridge the duct and are bolted to the rest of the core by means of two rows of insulated bolts. Oil enters and leaves these central ducts through openings in the yoke punchings. These openings in the yoke can be seen in two of the accompanying illustrations.

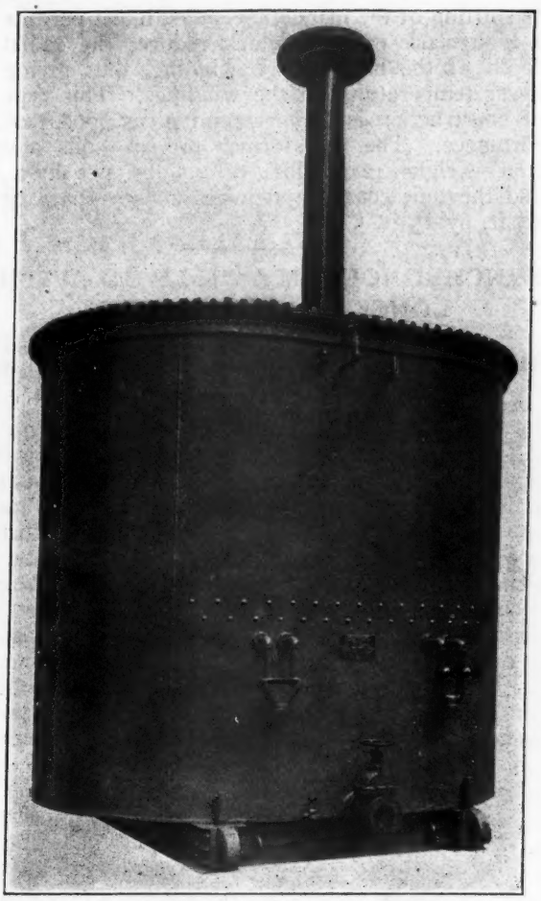


Fig. 6.—Transformer Case, Showing Oil Drain, Cooling Connections, Etc.

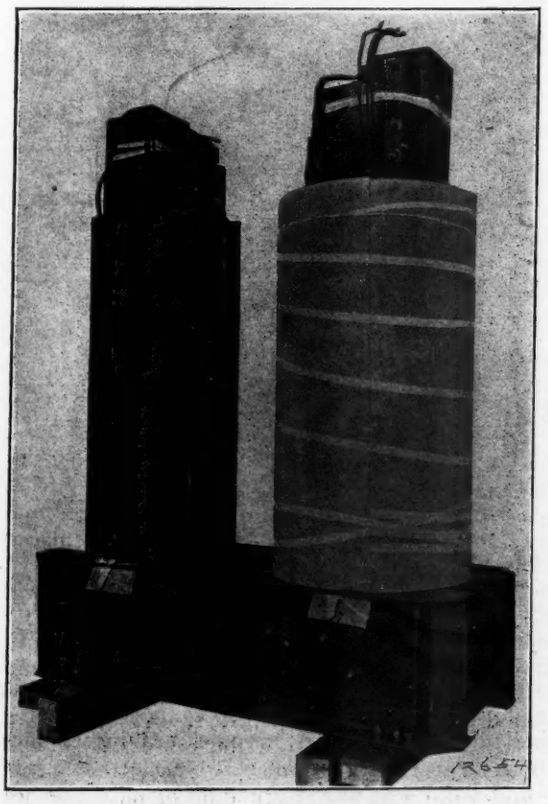


Fig. 5.—Partly Assembled Transformer, Showing Coils in Place.

The low-voltages windings are made up of four tubular-shaped coils, two on each leg. The individual low-voltage coils are one layer thick and are assembled together with ducts between them so that every conductor is directly exposed to the cooling oil. Over the low-voltage coils are placed insulating barriers built up of fullerboard impregnated with oil. These barriers provide the insulation between high- and low-voltage windings. The high-voltage winding consists of a stack of pancake coils on each leg. An accompanying illustration shows a schematic diagram of the high-voltage winding. The figure shows eight coils per leg; actually, there are 64 coils on each leg. The line terminal is located at the center of the transformer at a maximum distance from the yokes, the winding being divided into top and bottom halves. The coils of each half are connected in series back and forth between the legs, and the two halves are connected in parallel. This scheme of connections puts the ends of the windings next to the yokes at ground potential, thus eliminating the necessity for insulating supports between the high-voltage coils and yokes.

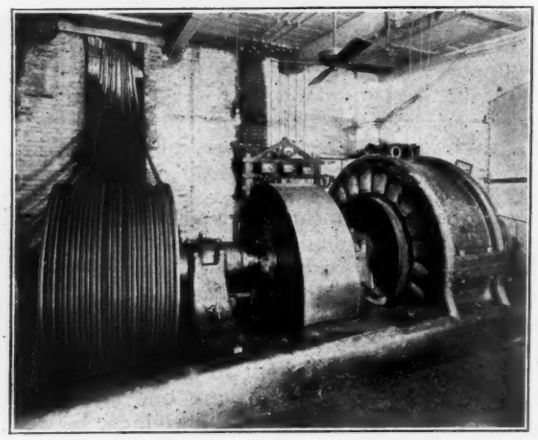
Elimination of the insulating supports at the top and bottom of the coil stack not only assures unobstructed ducts and reduces the possibility

of shifting of the magnetic centers, but it permits a high stack of coils which reduces the radial depth of the high-voltage winding, thus giving lower temperatures in the windings. This type of construction is compact and gives good performance. The transformer proper—coils and iron—weighs 42,000 lbs., or 2.5 lbs. per kv-a., and the unit complete requires a floor space of 10 ft. by 13 ft. 5 ins.

SYNCHRONOUS MACHINES WITH LONG SERVICE RECORD.

Machines and Switchboard Installed in 1895 Still in Operation With Prospect of Years of Steady Work Still to Be Done.

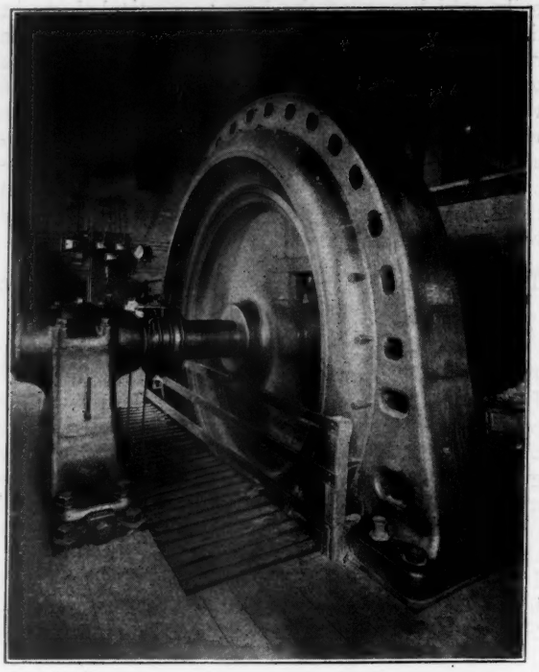
Owing to the rapid development of electrical apparatus during the past 30 yrs. some types only 5 yrs. old might, perhaps, be classed as museum pieces, while those 10 yrs. old or more are almost forgotten. This makes the motor, generator and switchboard in a textile mill at Pelzer, S. C., interesting from two standpoints; first, they were installed about 1895—26 yrs. ago—and, second, they have been running continuously ever since. All three were manufactured by the General Electric Co., Schenectady, N. Y., the generator being an AB 3450-volt, 120-ampere,



Synchronous Motor That Has Been in Service Ever Since 1895.

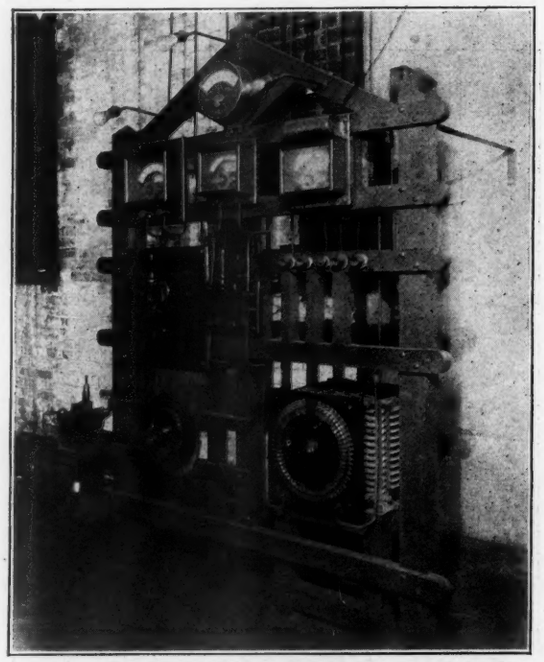
180-r.p.m. synchronous machine. It has been used as both a motor and a generator. The synchronous motor is a type AF 400-hp., 3000-volt, 360-r.p.m. machine which has been used as a motor since 1897. The switchboard is wooden slat affair with the original meters and resistances still on it. The only change made in it is that formerly the resistance was mounted with the handles on a bench so that the operator could sit between the two and operate them. The bench has now been removed and the handles placed on the boxes.

The whole outfit is an example of the primitive operating practices of those days. The generator was put on the line by the old dim-and-glow lamp system. As the result of the lamps being improperly connected for 8 yrs. it was thrown on the line out of step, three single-blade knife switches being used to throw it on. The motor starts direct on line voltages, without the use of a compensator.



Generator Installed in 1895 and Used Both as Motor and Generator.

In spite of the vicissitudes of service the old machines are still in good condition. No coils have been replaced on the generator or motor since 1895, nor have any other except very minor repairs been necessary. The Pelzer Manufacturing Co., owner of the apparatus, plans to use the



Switchboard Installed 25 Years Ago to Control Synchronous Motor.

motor as a generator to supply power for the individually motor-driven machines in its factory.

Turnover pays better than holdover, even when the price gage approaches the zero mark.

Joint Operation of Water and Steam Resources

California Utilities Inter-connect Systems to Conserve Water Resources and Save Fuel and Plant Capacity — Generator Speeds Varied to Feed Either 50- or 60-Cycle Systems to Exchange Power

By R. A. GULICK

Engineer, Southern California Edison Co., Los Angeles, Cal.

During 1919 the electric utilities of California were threatened with a power shortage the serious results of which were averted by a commendable co-operative policy looking toward the pooling of the entire generating resources of all companies. Lack of an adequate power supply was occasioned by a retrenchment in new plant construction during recent years and was accentuated, first, by the occurrence of an unusually light rainfall upon which water power plant capacity was dependent and, second, by an exceptional increase in the demand for power brought on by the business revival following the declaration of peace.

The Southern California Edison Co., operating in central and southern California, the San Joaquin Light & Power Corp. and the Mt. Whitney Co., operating in central California, possessed power resources and transmission lines situated so that it was possible by special arrangements to interconnect the systems. By such interconnections the combined power resources of these companies were operated most effectively.

These power resources consist of three elements, the first of which includes water power plants located on streams that have no reservoir control and whose output varies with the natural flow of the stream. These plants are called "base water power plants." Their output during certain months of the year in the "valley of the load" may exceed the load of the company operating the particular group of plants, although the combined valley load of all the companies may be able completely to absorb the combined output of all the base water power plants. Separate operation of all the companies would mean a wastage of water for power purposes, due to an inability to utilize all of the base water power output all of the time. Consolidated operation resulted in its entire use.

The second element includes water power plants located on streams with reservoir control. The output from these plants does not vary currently with stream flow, but is controlled to meet the requirements of the load. Reservoirs are filled during the months of April to July and drawn down during the other months. For the purpose of carrying the load in the fall months when the base water power plants are operating at reduced capacity, due to low stream flow, it is necessary that the storage water in reservoirs be sufficient to carry the load with the aid of base water power and steam plants. Combined operation made it possible to completely utilize the base water powers of all the systems in the spring, some of which under separate operation would have been wasted on one system while the load on another system would have had to be supplied from reservoir plants. The conservation of the base water power output resulted in storing more water in the reservoirs during the spring time for fall use.

The third element includes steam power plants used to supply the load demands above the total water power capacity. These plants are of various sizes and efficiencies and are brought into use to yield the required power at the least cost. The situation was such that it was doubtful that sufficient water could be secured in storage reservoirs to enable the load to be carried in the late summer and fall months without a serious curtailment. As soon as the impending shortage was foreseen arrangements were made to overcome it by interconnecting the systems and pooling the combined power resources. For the purpose of securing as much water as possible in storage reservoirs for fall use, all possible use was made of base water power plants and steam plants during spring and midsummer months. By making use of the combined base water power and steam facilities of these three companies during this period the draft on the reservoired water power plants was reduced to the minimum.

Arrangements to Conserve and Pay for Energy.

No definite arrangements as to settlement for power interchanged was made until after the plan was in operation. The basis of final settlement was for each company to pay for power received on the basis of generating cost, plus 50% of the saving to the receiving company, with a number of clauses as to the cost of power from the various resources. As soon as the interconnections were made power was interchanged under charge of the load dispatchers at Fresno and Los Angeles, with instructions to allow no water to flow to waste and to save fuel everywhere possible by operating only the necessary and most efficient steam units.

In cases where the interchange of power from one company to another was made, not for the purpose of effecting a saving in production expense, but solely to supply a load not capable of being supplied from the plants of the receiving company, the energy was sold at cost plus 15%. This arrangement resulted in each company making its excess plant capacity available to supply the surplus demands of the other at a profit to itself. The interconnection of these systems was considerably complicated by the fact that the Edison company operates at 50 cycles, while

the San Joaquin and Mt. Whitney companies operate at 60 cycles.

A bank of 15,000 kv-a. transformers was located at Strathmore, interconnecting the San Joaquin 60,000-volt, 60-cycle lines with the Mt. Whitney 30,000-volt, 60-cycle lines, and a portion of the 150,000-volt Big Creek line was operated at 60,000 volts for interconnecting, and arrangements made so that one, two or three of the 5000-kw. units at Kern River No. 3 could be switched from the Los Angeles 50-cycle line to the interconnecting line by speeding up the machine to 60 cycles. The Canyon plant was also arranged to operate either at 60 cycles into the interconnected system or by decreasing the generator speeds to 50 cycles to deliver power to the Kern River-Los Angeles line. At Magunden a 5000-kw. frequency changer connected the Kern River-Los Angeles 50-cycle line with the 60-cycle interconnected system. The arrangement proved very satisfactory in every way and has been continued.

During 1920 the Edison company completed the Kern River No. 3 plant and 60,000-volt lines, delivering 40,000 hp. to the San Joaquin valley. As a part of this project the Vestal substation, costing over $1,000,000, was built near Richgrove in Tulare county. The functions of the Vestal substation are to interchange power between the Edison company's 150,000-volt, 50-cycle system, the San Joaquin company's 60,000-volt, 60-cycle system, and the Mt. Whitney company's 60,000-volt, 60-cycle system. It also serves as an interconnection of Kern River No. 3 with any or all of above systems.

Since the installation of this more flexible and economical interconnection the equipment in Kern River No. 1, Magunden, Canyon plant, and Strathmore has been removed. In July, 1920, the Mt. Whitney company was merged with the Edison company, so that the power interchange between these two companies is now a matter of interchange between two parts of the same system.

The advantages of the interconnection between the Edison and San Joaquin companies still remain and are reflected in the operating expenses and development program of the companies. In operation no expensive steam power is generated until after the full capacity of all stream flow plants is used, and steam power is then generated at the most economical plants.

Economical development in the High Sierras requires that large blocks of power be brought in at one time and ahead of the load demand. The San Joaquin company has added during the last year 30,000 kw. to its hydraulic capacity and 12,500 kw. to its steam capacity. This gave that company a large excess capacity during certain months of 1920 and 1921, and the exchange of this otherwise waste power reduces the operating expense of both companies. The Southern California Edison Co. has recently added 70,000 kw. to its hydraulic capacity. So great has been the increase in demands of their consumers for power, however, that these increases do not relieve either company of the necessity for generating a considerable amount of steam power during the summer peaks which occur at the time of year when the base water power plants are operating at subnormal production on account of reduced stream flow.

During the spring and early summer of this year (1921) the San Joaquin company is supplying surplus water power from its unreservoired stream flow plants to the Edison company. The latter company, meanwhile, has shut down entirely its Big Creek No. 1 plant and is conserving the entire runoff into Huntington lake for use during fall and winter months. By so doing the surplus power of one company, which would otherwise go to waste, is substituted for steam power of the neighboring company, even though the period of available surplus of the one is not coincident with the load requirements of the other.

The development program on the upper San Joaquin river takes into account the probable surplus power available, so that new capacity will be brought in when demanded by the load requirements of the interconnected systems. In this way capital expenditures do not have to be made so far in advance of load requirements as if made to take care of only one company.

MOTOR-OPERATED CRANES USED FOR CARGO TRANSFER.

Speed of Unloading Greatly Increased and Labor Decreased by Installation of Modern Wharf Equipment.

By Henry Cunningham, Jr.
Manning, Maxwell & Moore, Inc., New York City.

An interesting installation of two Shaw overhead warf cranes may be seen at pier No. 6, East river, New York City, at the New York state barge canal terminal. These cranes were manufactured by Manning, Maxwell & Moore, Inc., New York City, at their Shaw crane works, Muskegon, Mich. They are of the overhead type traveling on two tracks, one carried over the front row of building columns and the other 10 ft. back over the roof of the pier. These cranes have four movements—travel, boom hoist, trolley rack and hook hoist. The boom which has an outboard reach of 32 ft. 6 ins. and an inboard reach of 10 ft. is pivoted to the traveling frame. The capacity of each crane is 3000 lbs. with the boom horizontal, or at any angle up to 45 deg., and with the trolley in any position of the boom.

The method of handling freight at pier No. 6 has many advantages. The cranes can be brought right to the location of the work without loss of

Cargo-Transfer Cranes at New York State Barge Canal Terminal.

time. The cranes travel on tracks above the roof, and so do not obstruct the apron of the pier. While traveling the boom is nearly vertical, in which position it can travel along the side of the pier shed with ample clearance of the shed and any ship's rigging. When the desired location for the crane is reached the boom is lowered, the outboard end being over the hatch of the vessel with inboard end reaching inside the pier shed. The load may be hoisted from the hold of the barge and deposited inside the pier shed, thereby serving a large floor space and relieving congestion due to hand distribution. The load is carried in a straight line, taking the shortest possible course from the hold of the barge to the floor inside the pier and eliminating the use of space necessary for swinging the old type of boom. By utilizing simultaneously the hook hoist and trolley movements the load may be carried on a diagonal line from the loading to unloading points. Thus, by traveling the shortest possible path the factors of speed and facility of handling are utilized at the utmost efficiency. The straight-line motion permits of operation at greater speed for a complete working cycle. The rapid handling of loads allows a correspondingly quick unloading of the barge, thereby effecting a considerable saving in the wharfage and demurrage charges.

Cranes Allow for Unloading of Two Barges at Once.

With the installation of two cranes, two barges —one inboard and one outboard—may be unloaded or loaded at the same time by placing the cranes so that one works a forward hatch of one barge and the other works an after hatch of the other barge. By the same arrangement the two cranes can work two hatches of one barge at the same time, thus speeding up the freight handling operation. When necessary to work on a vessel floating higher out of the water the boom may be raised to an angle up to 45 deg.

The operation of this type of crane is safe and simple due to the ready accessibility of the controllers, the solenoid-operated hand brake, the dynamic lowering feature and the fact that the operator always has the load in full view. The parts of the cranes are so proportioned that the factor of safety will in no case be less than five when the cranes are handling their rated load.

The hook hoist and rack have a speed of 125 ft. per min. with the full load, and 200 ft. per min. with no load, and the boom may be hoisted from the horizontal to the vertical position in 1 min. The traveling speed is 100 ft. per min. The hook hoist, trolley, rack and boom-hoist machinery is located on the crane frame well to the rear where it acts as a counterweight, thus giving stability to the crane. The hook hoist and rack are operated by separate motors and are independent of each other in speed and direction of travel, the operator's cage being suspended from the crane frame at one side of the boom and at sufficient height to give the operator a clear view of the load.

These cranes are equipped with 220-volt, d-c., fully inclosed type Z Shaw motors. The hook hoist and rack are operated by 18-hp., compound-wound motors, and the boom and travel motors are series wound and are rated at 8 hp. All the

View Showing Crane Moving a Package From Boat to Dock.

motors are equipped with a series-wound solenoid-operated hand brake, the controllers being of the drum type with vertical handles; the hook hoist and rack controllers are arranged for dynamic lowering, while the boom and travel are plan reversing.

Former Method of Freight Handling Slow and Tedious.

The former method of handling freight at pier No. 6 was by hand with the aid of a whip boom, block and tackle and a horse. The horse "walked away" with a line to raise the load from the hold of the barge, then the whip boom was swung around by hand in order to deposit the load on the apron of the pier. The load then had to be moved by hand to deposit it under the pier shed. Swinging of the whip boom necessitated having space enough to clear the boat's rigging and the side of the pier with the load suspended. This condition caused many delays. In order to lower the whip boom and hook into the hold the horse was walked backwards, which was a slow and tedious operation.

The new overhead wharf cranes handle loads which could not be handled at all with former method of freight handling, and with greater speed and facility. They save time and labor, thus reducing considerably the cost of freight handling. As an illustration, at Pier No. 6 with the former method of freight handling it took eight men with a whip boom, block and tackle and a horse 4 days to unload a barge of 175 tons of freight. With one crane and two men in the hold of the barge 175 tons of miscellaneous freight was unloaded in one day. As the crane was new to the men they were somewhat slow in having the freight in slings ready to be hoisted, and the hook was out in the hold waiting before the sling could be adjusted. The operating cycle

of the crane was 30 sec., while the actual working cycle was 70 sec., indicating that there was ample opportunity for still greater speed in unloadings. In fact, the barge in reference could have been unloaded in less than 4 working hours.

REVIEW OF BUILDING OPERATIONS IN JUNE.

Contracts Awarded in 27 Northeastern States Totaled $227,711,000—First Half of 1921 Makes Favorable Showing.

Construction activity in June, according to figures published by the F. W. Dodge Co., was 6% less than in May, although it was greater than in April. Contracts awarded during June in the 37 Northeastern states of the country amounted to $227,711,000. Those sections in which labor troubles have been most pronounced were the ones in which decreased building activity was evident. Furthermore, the latter half of June showed up more strongly than the first half. The two facts seem to indicate that the small decline in June was only a temporary setback. Included in the June total were the following items: $75,175,000, or 33%, for residential buildings; $52,967,000, or 23%, for public works and utilities; $25,493,000, or 11%, for business buildings; $23,441,000, or 10%, for educational buildings; and $18,502,000, or 8%, for industrial plants.

The first half of this year has shown up quite favorably in comparison with previous years. From Jan. 1 to July 1 the total amount of contracts awarded has been $1,066,256,000. This figure is 9.5% greater than the average semi-annual total for the preceding 5 yrs. Included in the total for the first 6 mo. of 1921 were the following items: $360,828,000, or 34%, for residential buildings; $242,701,000, or 23%, for public works and utilities; $144,488,000, or 13.5%, for business buildings; $104,194,000, or 10%, for educational buildings; and $86,940,000, or 8%, for industrial buildings.

Contemplated new work has been reported during the first 6 mo. of this year to the amount of $2,500,000,000.

In the New England states June building contracts amounted to $16,211,000, a decrease of 14% from the May figure. The June total included $7,004,000, or 43%, for residential buildings. Total construction contracts in this district during the first half of 1921 have amounted to $81,419,000, which is 24% less than the average half-yearly total for the preceding five years. Included in the total for the first 6 mo. of this year were: $30,985,000, or 38%, for residential buildings; $15,186,000, or 18.5%, for business buildings; $9,790,000, or 12%, for public works and utilities; and $9,388,000, or 11.5%, for industrial buildings. During the first half of 1921 contemplated new work in New England has been reported to the amount of $210,527,000, which is over 2.5 times the amount of contracts awarded in the same period.

Contracts awarded during June in New York state and northern New Jersey amounted to $62,659,000, an increase of 8% over the May figure. Of the June total 54%, or $33,882,000 was for residential buildings. Total construction contracts in this district during the first half of the year have amounted to $244,253,000, which is 35% greater than the average total for the first half of the preceding 5 yrs. The total for the first half of the year has included the following items: $135,083,000, or 55%, for residential buildings; $34,525,000, or 9.5%, for business buildings; $23,019,000, or 9.5%, for public works and utilities; and $16,006,000, or 6.5%, for industrial buildings. Contemplated new work has been reported for this district during the first half of the year to the amount of $682,554,000, which is more than 2.5 times the volume of contracts awarded in the same period.

Contracts let during June in the Middle Atlantic states, comprising eastern Pennsylvania, southern New Jersey, Delaware, Maryland, District of Columbia, Virginia, North and South Carolina, amounted to $32,136,000, a decrease of 27% from the May figure. The June total included $10,276,000, or 32%, for public works and utilities, and $7,112,000, or 22%, for residential buildings. Total construction contracts let in this district during the first half of 1921 have amounted to $160,333,000, which is 2.5% greater than the average total for the first half of the preceding 5 yrs. The total for the first 6 mo. of 1921 included: $56,308,000, or 35%, for residential buildings; $39,513,000, or 25%, for public works and utilities; $18,994,000, or 12%, for business buildings; and $14,675,000, or 9%, for industrial buildings. During the first 6 mo. of 1921 contemplated new work has been reported in this district amounting to $400,000,000, about 2.5 times the volume of contracts awarded.

Contracts awarded during June in western Pennsylvania, West Virginia, Ohio, Kentucky and Tennessee amounted to $47,225,000, which was an increase of 16% over the May figure. The June total included $13,834,000, or 29%, for public works and utilities; $9,936,000, or 21%, for industrial buildings; and $9,640,000, or 20%, for residential buildings. Total of construction contracts let from Jan. 1 to July 1, 1921, in this district has amounted to $215,568,000, which is 26% greater than the average for the first half of the 5 yrs. preceding 1921. In the total for the first half of this year were included: $69,701,000, or 32%, for public works and utilities; $57,845,000, or 27%, for residential buildings; $22,308,000, or 10%, for business buildings; $21,336,000, or 10%, for educational buildings; and $20,037,000, or 9%, for industrial buildings. During the first half of this year contemplated new work has been reported for this district in the amount of $312,131,000.

June building contracts in the Central West, comprising Illinois, Indiana, Iowa, Wisconsin, Michigan, Missouri and portions of eastern Kansas and Nebraska, amounted to $61,028,000, a decrease of 16% from the May figure. Included in the June total were $17,132,000, or 28% for public works and utilities, and $15,378,000, or 25%, for residential buildings. Total contracts awarded in this district during the first half of this year have amounted to $325,929,000, which is 1% greater than the average half-yearly total for the preceding 5 yrs. Included in the total for the first 6 mo. of 1921 were the following items: $89,088,000, or 30%, for public works and utilities; $71,287,000, or 22%, for residential build-

ings; $50,739,000, or 15%, for business buildings; and $46,500,000, or 14%, for educational buildings. During the first 6 mo. of 1921 contemplated new work has been reported in this district to the amount of $790,309,000, which is nearly 2.5 times the amount of contracts awarded in the same period.

Contracts awarded during June in Minnesota and North and South Dakota amounted to $8,452,000, an increase of 12% over the May figure. Of the June total, $3,311,000, or 39%, was for public works and utilities, $2,159,000, or 25%, for residential buildings. During the first half of 1921 total building contracts in this district have amounted to $38,755,000, which is 23% greater than the half-yearly average for the preceding five years. Included in the total for the first half of this year were the following items: $11,293,000, or 29%, for public works and utilities; $9,321,000, or 24%, for residential buildings; $7,648,000, or 20%, for educational buildings; and $2,735,000, or 7%, for business buildings. During the first half of 1921 contemplated new work has been reported in this district amounting to $114,942,000, which is about three times the total amount of contracts awarded during the same time.

NATIONAL LAMP WORKS CONDUCTS LIGHTING SCHOOL.

Representatives of 23 jobbers' organizations attended the Illuminating Engineering School held recently at Nela Park, Cleveland, under the direction of the National Lamp Works of General Electric Co. A total of 55 men, each actively engaged in the sale of lighting, attended the "short course" in illuminating engineering. Walter Sturrock, of the Illuminating Engineering Section, Engineering Department, National Lamp Works, was director of the school.

Fourteen speakers from the National organization gave 19 talks, each talk taking up one particular phase of the general subject of lighting covering both the engineering and sales sides. This "class work" was supplemented by several inspection trips, one to the Electrical League of Cleveland where the League's lighting demonstration was given, one to the League's Modern Electrical Home, one through the factories and engineering buildings at Nela Park and one to a Cleveland factory that had requested recommendations for a new lighting layout. At this factory the "students" secured the necessary data and later in the school made the actual lighting layout under the supervision of the National's engineers. Prizes were awarded for excellency in this particular design work.

The Illuminating Engineering School was all business. The horse-play, often characteristic of sales meetings in boom times, was conspicuous by its absence. "We came for information and we got it. It was worth many times its cost," declared an executive of a jobbers' organization that sent 22 representatives to the school.

NORWAY STUDYING AMERICAN TELEPHONE METHODS.

Germany is regaining a good part of her electrical trade in the Scandinavian countries, according to Sigurd Indrehus, maintenance engineer of the Bergen Telephone Co. of Bergen, Norway. Mr. Indrehus who was commissioned by the Norwegian Government to study telephone practices in the United States, has completed a 6 wks.' study in this country and is about to return to his native shores to apply the results of his observations to a new system of communication in Norway. Before the war Germany supplied practically all of the electrical requirements of Norway and Sweden, other than telephone equipment, Mr. Indrehus states. She controlled the cable and copper wire markets of the former country. Today she is endeavoring to regain the same ascendancy by taking advantage of the state of money change which makes American prices prohibitive on the other side of the Atlantic.

Mr. Indrehus has spent a large portion of his time at the research laboratories of the Western Electric Co. at New York City, and at Chicago he has visited the factories of several of the largest telephone manufacturers in this country, including the Western Electric Co.'s works near Chicago, the largest telephone plant in the world. In commenting upon the telephone practices in this country Mr. Indrehus said that he was particularly impressed by the rigid requirements and high standards maintained by the manufacturing and operating companies.

The telephone has become very popular in Norway. While there are few telephones compared with the per capita distribution throughout the United States, Norway ranks well up among its European neighbors in their efforts to extend communication facilities. The mountainous character of the country makes all additions to the telephone system very expensive ventures.

Men Who Attended Illuminating Engineering School Held at Nela Park by National Lamp Works of General Electric Co.

EDITORIAL COMMENT

Something for Nothing in Municipal Utility Service

It is a popular misconception often entertained by citizens that, where low rates for utility services are obtainable at the expense of taxpayers, the expense ultimately falls upon the property owning classes to the advantage of the nonproperty-owners.

It is well known that many muncipally owned utilities have been conducted at a loss, which is oftentimes obscured by insufficient methods of accounting which fail to give proper consideration to the questions of depreciation and adequate return upon the capital invested. This capital is usually represented by bonds, interest and principal of which must be paid out of taxes if it is not taken from operating revenues. Moreover, where depreciation is not properly covered by an amortization fund the investment will be gradually dissipated and in time the plant must either be abandoned or new bonds issued. These new bonds become an additional burden upon the taxpayers. Even where this condition is realized it is sometimes thought that the citizens in general are securing a benefit at the expense of the taxpayer; that is, the property-owning element of the community.

Such a point of view overlooks the fact that taxes do not always come out of the pocket of the one who makes the direct payment to the collector, but are frequently paid indirectly by other classes of citizens. Where taxes are levied in the form of license fees, or as personal property taxes, upon the equipment of stores, factories, etc., or upon the buildings in which such mercantile and industrial businesses are carried on, it should be realized that the taxes constitute one of the expenses of carrying on the business and must ultimately come out of the revenues which the consumer has to pay. A large proportion of taxes, therefore, are paid indirectly by the ultimate consumer of the materials handled in industrial and mercantile operations; in other words, upon the general citizen regardless of whether he be a property holder or not. Probably the only form of direct tax which is not passed on to the consumer is the tax which is levied upon land values or other forms of property which do not represent the accumulated product of labor. Ground rent is collected in any case to the full extent of its value and is also ultimately paid by the final consumer, and the tax upon such value merely deflects a portion of such ground rent into the public coffers. The consumer has this burden in any case, but his burden from the classes of property previously mentioned is determined by the tax rate; consequently any idea that the consumer is getting something for nothing in case taxes are levied upon general property (as is the case in almost all communities) by having the municipality supply free service for such utilities as schools, parks, etc, or partly free services, as it does where an inadequate rate is charged for electric current, is fallacious.

Designing Electrical Equipment as Part of the Plant

The advantage of designing the electrical equipment for industrial plants at the time the building is laid out, and before construction has started, is obvious. In this respect the factory building is no different from the residence, the store, the office, etc. In every case the best results from the utilization of electrical equipment can only be obtained when it is designed as an integral part of the building and when the wiring is so arranged that the outlets are found to be in the most convenient place when the time comes to attach the various devices.

In the case of the factory, however, more is involved than proper provision of conduit capacity and outlets. The entire system should be decided upon in advance and not only the type of equipment and its location fully determined, but arrangements for distribution fully worked out. Where energy is purchased it is frequently necessary to have a small substation upon the premises of the consumer, and unless space is provided for this in the original building plans there is likely to be difficulty later through the compromise of efficiency and convenience to suit the conditions which are imposed by the completed building. Where a private power plant is to be installed careful consideration is necessary in determining upon the most suitable voltage, size of units, type of prime movers, switching arrangements, etc.

In considering the power requirements it is, of course, necessary to have the entire electrical drive designed, and provision must then be made for losses and an estimate formulated as to the power which will actually be used. The choice of control equipment, the method of mounting motors, and various other details should all be de-

cided upon in advance and then the electrical equipment can be installed as an integral part of the complete plant. Where such a plan is followed the electrical equipment will not look like an afterthought, with the accompanying detriment to the appearance, efficiency and usefulness of the apparatus, but can be made to appear as a part of the plant and to operate as it should.

Central Station Commercial Records

Central station managers have striven to standardize their plant, distributing systems, metering systems, bookkeeping methods and systems of accounts, but it has only been within recent years that a few of the more progressive companies have made any effort to systematize the keeping of new-business records. Of course nearly every central station has adopted some systematic method of keeping prospects classified, usually a card-index system, but this is in the majority of cases the extent to which records are kept.

For residence and commercial-lighting customers the problem of new-business records is comparatively simple. A card index containing the customer's name, address, business, number of lamps installed—interior, show-window, sign, etc.—heating appliances, etc., with dates and data for future calls would suffice. In connection with the last two items it is well to point out that this feature is equally as important with old customers as with prospective new ones.

Keeping of power records entails more work, but the importance of such records cannot be too strongly emphasized. Data on every power installation should be compiled and preserved in a suitable file. Information should be obtained for each installation as to the number of motors, aggregate horsepower, size, type and speed of each motor, the machine or machines which it operates, maximum demand of the installation, load-factor, monthly kilowatt-hour consumption, and monthly bill. Supplementing this the construction or engineering department should be required to prepare for the commercial department a diagrammatic layout of each plant in which it makes a motor installation, such drawings to be filed with the power records mentioned above.

It is obvious that with this data at hand the commercial department will be enabled to keep closely in touch with its customers and always be in a position to adjust complaints promptly and satisfactorily, or make additions or improvements to an existing installation without loss of time or inconvenience to customers. Also, power solicitors will have data available with which to meet any similar propositions that may arise within their province.

When Should Repairs Be Made?

Repairs should always be made when they are required, but it is often an open question as to when repairs are required. It is safe to say that now—July—is the time to make repairs in most power plants. Many operators have already taken a portion of their equipment out of service for inspection and general overhauling, but there are a great many others who have not. To be sure there is still a long period before the full capacity of the steam plant will be required to meet the cold days of the coming winter, but each day of delay shortens this time by just so much.

When a piece of equipment is taken out of service for general repair it is never possible to say just how many days the job will take. This is particularly true of boiler plant apparatus. Everything may look good enough for another year of service from the outside, but close examination may reveal faults or impending faults that require extensive new work to assure reliability when the strains of winter loads are met. It is a move in the interest of reliability of service to shut down each unit in the boiler plant during the summer and give it a thorough examination from top to bottom and from front to back. Every sheet, tube, seam, valve, gage, gasket, pipe, fitting and rivet should be covered in this examination. The breeching and damper should be inspected, the baffles and brickwork should be examined, and the stoker and ash-handling equipment subjected to minute scrutiny.

It might be well to enumerate every item that enters into the construction of a plant and then suggest that each one be examined in this annual summer inspection. But the careful engineer will make out his own list and the shiftless one will neither make out a list nor use one that might be provided for him. Pet cocks, small valves, lubricators and lubrication pipes, draft gages, damper controls, inspection doors and oil cans all can give a great amount of trouble during the trying days that come with winter, unless they are put in proper order when time is available to attend to such matters.

This inspection, testing and repairing should be carried through the entire plant, and every pump, engine, generator, switch and steam line should be put in first-class order before Oct. 1. Then the operating force can view the approach of the cool weather with assurance that everything is in order. There will be few, if any, times when service cannot be maintained, and when service does fail it will be because of unforeseen conditions rather than because of neglect.

Repair and inspect now, and meet the winter season with a sound plant.

Reliability of Modern Electrical Equipment

Few manufacturing plant executives realize the important fact that modern electrical equipment is one of the best kinds of insurance both in respect to fire and continuous production. The entire operation of a plant depends upon the power supply, and in case a single motor stops it directly affects the output. A number of shutdowns and delays can be avoided by the proper selection of electrical equipment and by having the installation planned to possess the inherent qualities necessary to stand an enormous amount of abuse.

The layout and installation of the wiring for an industrial plant should receive the same careful attention as the layout of machine tools. Unfortunately, the wiring is not considered until the buildings are nearly ready for occupancy and the rule of thumb methods are given preference over a careful study and systematic layout. When designing an installation it is far better to analyze every condition, including the shortest and best methods for running the feeders, the size of the wires both for present and future requirements, the choice between open wiring and steel conduit, and methods of reinforcing the feeders for future demands. The voltage to be adopted and the question of using alternating or direct current must also receive careful attention.

The choice between alternating and direct current is a problem which can only be solved by knowing all the conditions to be met. When a plant does not demand variable-speed motors alternating current will prove very satisfactory, as the voltage can be easily raised for long-distance transmission, and it allows a higher voltage for motors than for lighting without a great loss. However, special conditions usually govern such a selection in any given case. The chief factor is to know the facts relative to the power supply and the power demand. Then wiring, lights and motor equipment may be provided to give the desired service with the existing power supply.

The Highway Lighting Problem

The problem of providing proper lighting for country roads is to receive careful consideration in the construction of the "Ideal Section" of the Lincoln highway.

The great increase in the volume of heavy freight trucking on main routes between large centers, where in many instances motor express lines operate on regular schedules and frequently at night, along roads already congested with a heavy passenger traffic, has brought the question of illuminating rural highways to the foreground.

A number of important main highways have been lighted for certain distances through the open country, but it is doubtful if a careful and detailed scientific study of the problems involved has as yet been made. The methods employed to light such highways, as have been illuminated, have varied with the ideas and finances of the many scattered counties and communities undertaking such lighting. The results have frequently been disappointing. In fact, many drivers have complained that some methods of lighting rural highways defeat their own purpose in making the highway even more dangerous for night travel than if it were left totally dark and drivers left to depend upon their own headlights.

Certainly the providing of a brilliant light at stated intervals, over crowded routes of travel does not answer the purpose. Such lights if placed at improper heights, shine in the driver's eyes, or on rainy nights are reflected from the pavement.

The purpose of lighting rural highways is solely to provide for the safety of night drivers. Accidents which occur after dark are generally the result of the injudicious use of glaring headlights. The lighting installation which would permit of all vehicles operating with their headlights dimmed, as in cities, would undoubtedly make for safer conditions.

The technical committee appointed by the Lincoln Highway Association to determine the specifications for the "Ideal Section" of the Lincoln highway, that standard of excellence for American highway building which the Lincoln Highway Association will construct at some central point on the great transcontinental highway, early agreed unanimously that the "Ideal Section" should be lighted. They did not attempt to say how. The problem was one for the best illuminating experts and engineers obtainable. Now arrangements have been made by the Lincoln Highway Association with the General Electric Co. of Schenectady, N. Y., whereby the illuminating experts of that organization will develop an ideal lighting installation which will be put in along the "Ideal Section."

W. D'Arcy Ryan, chief illuminating engineer of the General Electric Co., the man who originated and developed the lighting arrangements for the Panama Pacific Exposition, will with the assistance of his staff, develop in consultation with the Association's consulting highway engineers, the best, safest, most economical and satisfactory lighting installation possible. Mr. Ryan and other officials of the General Electric Co. are greatly interested in the problems presented and mean to provide an installation along the "Ideal Section" which will serve as an example for the lighting of thousands of miles of American highways during the coming years.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

VALUE OF UTILITIES POINTED OUT AT OHIO CONVENTION.

Ohio Electric Light Association in 27th Annual Convention Discusses Rate Making, Transmission and Distribution Problems.

How Ohio electric light and power central stations save money, time and man-power for a community was pointed out by Col. Dudley J. Hard, of Cleveland, president of the Ohio Electric Light Association, in opening the 27th annual convention of that body at Cedar Point, O., July 12. "The value of the central station to the growth of the community, the saving in time, labor, capital and production costs, which it affords to industry, have never been so generally admitted and so much appreciated as at this moment," he said.

"As a concrete example of what I mean, I may cite the instance of a central station in one of our Ohio cities, which in the past 6 yrs. has expended $10,000,000 for line and station extensions in order to provide for the demands of industrial plants. Had these concerns put in their own individual plants, it has been carefully estimated that the cost would have amounted to $22,500,000, which means that the central station effected a saving of $12,500,000 in productive capital alone, not to mention a saving of more than 1,000,000 tons of coal and corresponding economies in labor and time. An industry which possesses such economic virtues can not be treated with indifference.

"Consequently, we find regulatory bodies today recognizing the principle that utilities are essential to the community welfare, and that a utility cannot be successful in achieving its greatest good unless it be protected from the attack of the agitator and the demagog, and unless the financial return permitted be sufficient to enable it to keep pace with its community, in other words, unless it is prosperous. Only under such conditions will the investor become interested and the capital to insure good service and future expansion, be obtained."

W. S. Merrill, Nela Park, Cleveland, submitted the report of the Illumination Committee at the opening session, which was followed by a symposium on street lighting.

On Wednesday morning F. A. Newton, Consumers Power Co., Jackson, Mich., gave an address on "Rate Making," and S. C. Henton of Akron, O., presented the report of the Meter Committee; Prof. A. M. Wilson, University of Cincinnati, reported for the Transmission and Distribution Committee, and J. C. Matthieu, Dayton (O.) Power & Light Co., submitted the report of the Farm Service Committee.

Thursday morning's session was taken up with a report of the New Business Co-operations Committee by M. W. Arthur, Akron, O., and J. L. Gaston, Covington, O., while in the afternoon the work of the Ohio Committee on Public Utility Information in its effort to build good-will for public utilities by keeping the people of the state informed of the operations of their utility companies, was discussed by Benjamin E. Ling, director of the Committee, and Attorney G. C. Maxwell, former secretary of the Ohio Public Utilities Commission.

It was stated that more than $110,000,000 is now invested in privately owned electric light and power plants in Ohio. During the past year alone close to $20,000,000 has been added to this investment for the purpose of meeting the ever increasing demand for electrical energy in Ohio. Ohio's industries are depending more and more for their current upon the central stations of the state, as is evidenced by the fact that there are now more than 400,000 workmen employed in factories using central station power.

Friday's session was given over to the election of officers and the discussion of miscellaneous matters. Further details of the convention will appear in a future issue of ELECTRICAL REVIEW.

A. M. E. S. FORMULATES PLANS FOR FUTURE WORK.

Various Sections of Association Elect Officers and Committees—Radio Apparatus Section to Have Booth at Pageant of Progress.

As a result of the summer meeting of the Associated Manufacturers of Electrical Supplies recently held at New London, Conn., many of the sections formulated plans for the ensuing year and elected officers and committees.

The Air Circuit-Breaker Section elected as its chairman, C. T. Evans, Cutler-Hammer Manufacturing Co., Milwaukee; treasurer, T. A. McDowell, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., and secretary, E. C. Raney, Automatic Reclosing Circuit Breaker Co., Columbus, O.

W. M. Stearns, General Electric Co., Schenectady, N. Y., will serve as chairman of the Heating Appliance Section, while Harold Fulwider, General Electric Co., Schenectady, N. Y., and L. S. Foulkes, Rochester (N. Y.) Stamping Co., will act as secretary and treasurer respectively. The following committees were also appointed by this section: Executive Committee, W. M. Stearns, chairman; F. F. Fashee, Harold Fulwider, E. N. Lightfoot and H. S. Merrieless. Domestic Appliance Committee, H. S. Merrieless, Manning-Bowman Co., New York City, chairman; W. A. Baker, American Electric Heater Co., Detroit; L. S. Foulkes, Rochester (N. Y.) Stamping Co.; J. S. Kennedy, Landers, Frary & Clark, New Britain, Conn.; J. F. Killeen, Edison Electric Appliance Co., New York City; F. R. Kohnstan, Westinghouse Electric Products Co., Mansfield,

O., and Thomas Mahaffey, Rutenber Electric Co., Marion, Ind. Range Committee, F. F. Fashee, Westinghouse Electric Products Co., Mansfield, O., chairman; J. F. Killeen, Edison Electric Appliance Co., New York City, and A. L. Smith, Walker & Pratt Manufacturing Co., Boston. Industrial Heating Committee, Harold Fulwider, General Electric Co., Schenectady, N. Y., chairman; E. N. Lightfoot, Cutler-Hammer Manufacturing Co., New York City, and W. S. Scott, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Technical Committee, E. N. Lightfoot, Cutler-Hammer Manufacturing Co., New York City, chairman; Lyneham Crocker, Simplex Electric Heating Co., Cambridge, Mass.; Frank Kuhn, American Electric Heater Co., Detroit, Mich.; H. J. Manger, Edison Electric Appliance Co., Chicago, and Frank Thornton, Westinghouse Electric Products Co., Mansfield, O.

Two sessions were held by the newly formed Radio Apparatus Section, and ways and means for removing the manufacture of radio apparatus from the amateur class to a high grade industry, as well as publicity and advertising plans, were discussed. D. R. W. Murdock, William J. Murdock Co., is chairman of this section and the following chairmen of designated committees were chosen: Committee on the Advancement of the Art, L. G. Pacent, Pacent Electric Co., chairman; Committee on Receiving Sets and Associated Equipment, M. C. Rypinski, Westinghouse Electric & Manufacturing Co., chairman; Committee on Transmitting Sets and Associated Equipment, C. F. Cairns, Acme Apparatus Co., chairman; and Committee on Aural Receiving Devices and Accessories, D. R. W. Murdock, chairman.

It was also voted that the section have a booth in the radio exhibition and convention to be conducted by the Ninth Radio District in connection with the Pageant of Progress Exposition scheduled to take place in Chicago, July 30-Aug. 14.

GREAT LAKES REGIONAL MEETING PLANNED.

St. Lawrence River Project and Gear Tooth Manufacturing to Be Discussed by Cleveland Section of A. S. M. E.

The Cleveland Section of the American Society of Mechanical Enginers has arranged for a Great Lakes regional meeting to be held Oct. 3-4 at Cleveland, with headquarters at the Hotel Winton. The announcement of the meeting states that the inspection trips through Cleveland manufacturing plants will cover only those factories wherein the latest methods are used in conjunction with the most recent developments in equipment and machinery.

The technical program is scheduled for Tuesday, Oct. 4, and will consist of two principal papers and two or more supporting papers presenting additional phases of the main subject. E. J. Lees, president of the Lees-Bradner Co., Cleveland, will present the subject "Grinding and Measuring Involute Gear Teeth" at the morning session, beginning at 9:30 o'clock.

At the afternoon session, opening at 1:30 o'clock, Hugh L. Cooper, consulting engineer of New York City, will give an illustrated address dealing with the St. Lawrence river project. He will discuss this important proposed source of power and improvement in Great Lakes shipping possibilities from the viewpoint of an engineer who has studied and been closely allied with numerous large power developments. Specializing on the design and practicability of large hydroelectric plants the speaker brings to his subject a vast accumulation of data of value not only to the engineer in the territory immediately adjacent to the St. Lawrence river, but also of economic importance to engineers in all branches of the profession throughout the territory now tributary to the Great Lakes.

This paper will be followed by others bearing especially on the economic and political considerations affecting the feasibility of the project. Engineers from Chicago, Cincinnati, Cleveland, Buffalo, Detroit, Pittsburgh, Toronto, Indianapolis, Erie, Rochester, Dayton, Columbus and Toledo are invited to participate in this meeting.

A. I. S. E. E. TO HOLD CONVENTION IN CHICAGO.

Electrical Development in Steel Mills, Standardization and Safety to Be Discussed—Prominent Men to Present Papers.

At the 15th annual convention of the Association of Iron and Steel Electrical Engineers to be held at the Hotel LaSalle, Chicago, Sept. 19-24, papers will be presented on the subjects of "Education," "Standardization," "Safety," and "Electrical Development in Steel Mills." In connection with the convention there will also be exhibits. It is announced that special stress and emphasis will be given to steel-mill problems and steel-making practices.

Among the prominent men who will present papers at the Chicago meeting are the following: R. B. Gerhardt, electrical superintendent of the Bethlehem Steel Co., Sparrows Point, Md.; R. D. Cousins, electrical engineer of the Illinois Steel Co., Gary, Ind.; Wray Dudley, electrical superintendent of the Ashland (Ky.) Iron & Mining Co.; W. N. Flanagan, steam engineer, Ohio works of the Carnegie Steel Co., Youngstown, O.; F. B. Crosby, electrical engineer of the Morgan Construction Co., Worcester, Mass.; A. C. Bunker, electrical engineer of the Crocker-Wheeler Co., Ampere, N. J.; A. M. MacCutcheon, designing engineer of the Reliance Electric & Engineering Co., Cleveland, and E. T. Moore, electrical engineer of the Holcomb Steel Co., Syracuse, N. Y.

ELECTRICAL PORCELAIN DISCUSSED BY CLAY WORKERS.

Electrical porcelain manufacture was one of the important topics discussed at the regular summer meeting of the New Jersey Clay Workers' Association and the Eastern Section of the American Ceramic Society, held at Trenton, N. J., last month. Reference to the subject was brought out in an interesting paper by Prof. Arthur S. Watts, Ohio State University, Columbus, O., on the subject of "Factory Preparation and Burning of Whiteware Bodies." It was pointed out that European porcelains do not contain any ball clay, and interesting information was given on the han-

dling of ball clays for porcelain production in the United States and the care that must be exercised. Complete explanation was given on kiln firing for electrical porcelain production.

The organization, headed by Charles Howell Cook, president of the Cook Pottery Co., Trenton, N. J., manufacturer of electrical porcelain products, as chairman of the Executive Committee, is well represented in this line of industry, and the Trenton meeting included many in this line, among the 100 members and guests present. It was brought out at the meeting that contracts totaling $100,000 have been let for the erection of a new ceramic school and research station at Rutgers College, New Brunswick, N. J.

ELECTRICAL CO-OPERATIVE LEAGUE ORGANIZED IN DENVER.

An organization known as the Electrical Co-operative League has recently been launched in Denver, Colo., under the guidance of an advisory committee, the personnel of which is as follows: Chairman, T. O. Kennedy, general superintendent of the Denver Gas & Electric Light Co.; vice-chairman, E. C. Headrick, a prominent contractor-dealer, and secretary-treasurer, John J. Cooper, Mountain Electric Co. Offices have been opened at 301 Gas and Electric building under the direction of Sidney W. Bishop, recently appointed executive manager of the League.

Extensive plans have been made to assist in the furtherance of the electrical industry by better service, educational and advertising campaigns and closer co-operation within the industry itself. All four branches of the industry are represented in the League, the local contractor-dealers' association holding membership as a unit.

UTILITY COMPANY GIVES ELECTRIC RANGE DEMONSTRATIONS.

Sales of electrical appliances in June continued in good volume in all parts of the territory served by the Public Service Co. of Northern Illinois, especially in the larger towns. As has been the case for a considerable time the demand was led by the labor-saving devices, states the company, though the suddent descent of warm weather had the effect of increasing sales of other articles, such as electric fans and electric cooking appliances. Some special work was done in several places in behalf of the electric grill with good results. Irons moved out to quite an extent. Special offers were made covering these implements.

During that month demonstrations of the electric range were made in several parts of the territory. In connection with one of these exhibits half a dozen or more towns surrounding the one in which the demonstrators conducted their operations were "billed" in newspaper advertising and the residents were invited to be present. There was a very good response and sales of ranges followed. In the demonstrations the efficiency of the range in varied cooking performances was shown. Plans of the Retail Merchandise Sales Department include a strong "push" for the electric range. It is expected the record of ranges connected up for service last year will be increased in 1921. The large amount of national advertising which has been done by the manufacturers has helped familiarize the public with this appliance.

ITALIAN ELECTRICAL ENGINEERS VISIT CHICAGO.

Four Italian electrical engineers, representing both the privately-owned and the government-controlled roads of Italy, arrived in Chicago recently to study with local railroad men and to confer with officials of electrical manufacturing companies in this city. The chairman of the delegation is Guido Semenza, of Milan, consulting engineer, past president of the Associazione Electrotecnica Italiana and a member of the American Institute of Electrical Engineers. The other members are Col. Cesare Scarelli, head of the railway transportation service, general staff of the Italian army; Marquis F. Cusani, business manager of the Italian-American Electric Co., and E. Boschetti, secretary.

"MYSTIC STOVE" TO BE A FEATURE AT PAGEANT OF PROGRESS.

A "Mystic Stove" will be a feature in the Electrical and Utilities Section of the Pageant of Progress Exposition to be held on the Municipal Pier, Chicago, July 30-Aug. 14. Cooking by magnetic induction is the way the inventor, C. H. Thordarson, explains it. By placing an ordinary frying pan on a bit of tapestry covering a table, it is stated that enough heat is developed to do any sort of cooking, or by putting on a tea kettle steam will start pouring out in a short time. You can cook a full-fledged meal on this mystic table—ham and eggs, biscuits and coffee. While the kettle is boiling and the ham and eggs are cooking, you can place your hand on the cloth covering the table and not a trace of heat will be felt while the cooking is in progress. There are no wires, no electrical connections whatever, but as soon as the frying pan or kettle touch the table, the ham

Cooking Demonstration on "Mystic Stove."
Left to right: George B. Foster, Miss Helen Mullane and C. H. Thordarson.

and eggs begin to fry and the water to boil furiously. The mystic stove, or table, more properly, will send heat right through ice and cook a meal for you.

Tests of the remarkable achievements of this mysterious cooking device were made recently in the presence of George B. Foster, of the Commonwealth Edison Co., who is chairman of the Electrical Section of the Pageant of Progress Exposition, a number of Chicago women and the inventor. Miss Helen Mullane did the cooking, and the entire party partook of the repast cooked on the "Mystic Stove." While the cooking was in progress Mr. Foster and others placed their hands on the cloth covering the table and felt not the slightest trace of heat. Mr. Thordarson, the inventor, expects this mystic device to cause the visitors to the exposition on the pier to stand in awe as they watch the demonstration.

WILL EXTEND WORK OF NORTHWEST SERVICE LEAGUE.

D. I. Miller, secretary-manager of the Northwest Electric Service League, has opened League offices at 535 Central building, Seattle, Wash. This organization seeks better co-operation among electrical contractors and dealers, power producers, jobbers and manufacturers. The League will extend its work throughout Oregon, Washington, Idaho and Montana. W. D. Moriarty was recently appointed to take up the work as a field man.

NEW ORLEANS UTILITY TO OMIT FURTHER INSTALLATIONS.

The Public Utilities Co., New Orleans, La., has issued an announcement through J. D. O'Keefe, receiver, that no new installations for electric light and power or gas can be made at the present time as the system has reached its capacity limit and the load, even now, is greater than can be handled safely and to good advantage. The company went into a receivership a number of years ago and plans for a reorganization have been interfered with by the city, which demands a return of 8% on a valuation of $44,700,000, and which, it is held by the company, is too high to show a reasonable profit through operation on the investment.

HYDROELECTRIC PROJECT PLANNED FOR FORMOSA.

The Bureau of Foreign and Domestic Commerce has received from Consul Henry B. Hitchcock, Taihoku, Taiwan (Formosa), a copy of the specifications and drawings for the mechanical and electrical equipment of the Jitsugetsutan (Lake Candidius) hydroelectric project to be constructed by the Taiwan Electric Power Co., which has been forwarded to the bureau's New York City office, 734 Customhouse, in order that it may be more readily consulted by interested persons. (Reference should be made to File No. 29632.)

The generating station is to consist of six 20,000-kw. a-c. generator units directly coupled with Pelton type waterwheels operating under a mean actual head of about 1370 ft. In addition to the main waterwheels and generators, the specifications also call for water-driven exciter units, penstocks, governors, valves, eighteen 7400-kv-a. stepup transformers, switchboard, and switching equipment, and other auxiliary apparatus, including a traveling crane. For the two substations there will be required twenty-one 7000-kv-a. stepdown transformers, three synchronous condensers, and the switching and other auxiliary equipment in connection therewith.

BENEFITS OF PUBLIC UTILITIES.

In general, the greater the undertaking of the public utility, the greater the benefit to the consuming public. By acquiring efficiency of production the public utility is enabled to offer commodities of a better grade and lower cost to the communities in which these services are diffused. The public reaps the benefit of co-operative organization.

EARLY ELECTRIC RAILWAY DATA.

The first electric railway in the world was installed by a man named Siemans at the Berlin exhibition in 1879, according to the American Electric Railway Association. The current was taken through a dynamo and conveyed through the rail. In 1886, a line was constructed by Leo Daft in Baltimore and this seemed to have been fairly successful. The first successful overhead trolley line was installed in Richmond, Va., by Frank J. Sprague in 1887. A score of short lines were built throughout the United States during the period of 1885-87. Most of them ran but a short time. The real start of the electric railway came after Sprague had completed his Richmond line.

COMING CONVENTIONS.

National Association of Electrical Contractors and Dealers. Anniversary convention, Buffalo, N. Y., July 18-23. Headquarters, Lafayette Hotel. Secretary, W. H. Morton, 110 West 40th street, New York City.

Pennsylvania State Association of Electrical Contractors and Dealers. Semi-annual meeting, Buffalo, N. Y., July 19. Headquarters, Lafayette Hotel. Secretary, M. G. Sellers, 1518 Sansom street, Philadelphia.

Pageant of Progress Exposition, Municipal Pier, Chicago, July 30-Aug. 14.

Michigan Electric Light Association. Annual convention, Ottawa Beach, Mich., Aug. 24-25. Headquarters, Hotel Ottawa. Secretary, Herbert Silvester, Ann Arbor, Mich.

New England Geographic Division of the National Electric Light Association. Annual convention, New London, Conn., Sept. 6-9. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, 149 Tremont street, Boston.

Association of Iron and Steel Electrical Engineers. Fifteenth annual convention, Chicago, Sept. 19-24. Headquarters, Hotel La Salle. Secretary, John F. Kelly, Empire building, Pittsburgh.

Illuminating Engineering Society. Annual convention, Rochester, N. Y., Sept. 26-30. General secretary, Clarence L. Law, 29 West 39th street, New York City.

New York Electrical Show, 71st Regiment Armory, Park avenue and 34th street, New York City, Sept. 28-Oct. 8. General manager, George F. Parker, 124 West 42d street, New York City.

Cleveland Section of the American Society of Mechanical Engineers. Great Lakes regional meeting, Cleveland, Oct. 3-4. James Guthrie, Fidelity building, Cleveland.

OPERATING PRACTICE

Methods and Problems Embracing Operation and Installation of Power-Plant Equipment and the Distribution of Electrical Energy

SMALL MAINTENANCE CHARGE WITH MECHANICAL STOKERS.

Actual Figures Show That Repair and Similar Costs Do Not Wipe Out the Great Fuel and Labor Savings Made by Stokers.

Everyone admits that mechanical stokers are practical in large plants, because there are no large plants in the country where hand firing is employed. But in the small plants, and in plants of medium size, many arguments are still made in favor of the old methods. For one who has seen the results of changing over from the old hand-firing method of operation to stoker operation it is rather difficult to see why some managers and some engineers still refuse to understand the advantages of modern methods in the boiler room.

Facts relative to the operation of Taylor stokers are well presented in a booklet being distributed by the American Engineering Co., Philadelphia. The 45 pages of the booklet are about half taken up with illustrations of actual plants where Taylor stokers have accomplished worthwhile results, the remaining pages being devoted to discussion of actual operating facts and figures. The following quotation shows interesting data on the maintenance of mechanical stokers:

"There is a persistent belief in the minds of many men that no matter what the advantages of a mechanical stoker in increasing capacity and reducing coal and labor items, these are more or less offset by terrific upkeep charges.

"When properly operated, the upkeep on Taylor stokers is extremely low.

"Of the Quincy Mining Co., Hancock, Mich., where five boilers are fired by Taylor stokers at 160 to 175% of rating continuously, one of our traveling inspectors says: 'The superintendent advised me that there had been practically no repairs on the Taylor stokers since they were installed, except on two occasions.

"In a plant near Wilmington, where Taylor stokers have been operating under five 300-hp. boilers since 1911, stoker upkeep has averaged $30 per stoker per year.

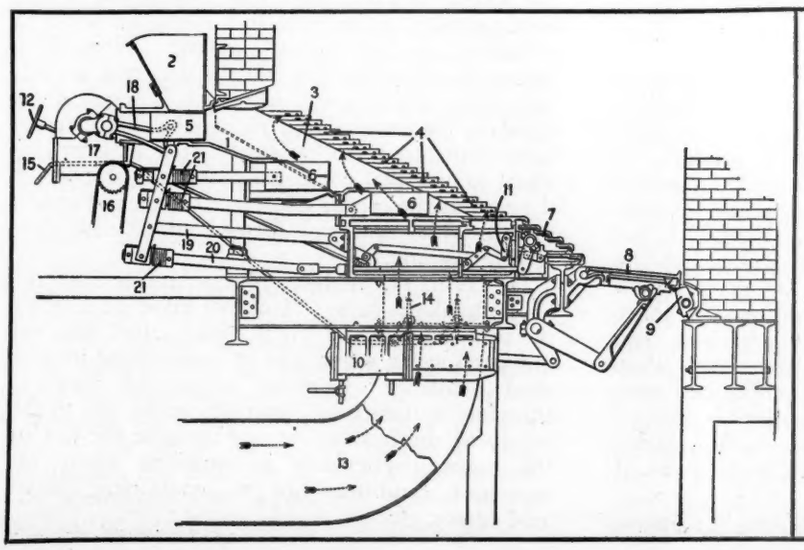
"An inspector's report from a Pennsylvania steel foundry states: 'The chief engineer says that the efficiency is all that could be desired and the maintenance practically nothing, and he also says that if we have any prospective customers in his district, to send them around and he will help us sell them Taylor stokers.'

"A large traction station in western Ohio, with Taylor stokers under five boilers operated at high over-ratings, reports a total of $109.39 stoker repair cost from Aug. 1, 1918, to Jan. 1, 1920. A Canadian automobile tire manufacturer engineer reports that his stoker repair cost for the 30 mo. since the Taylor stokers have been in operation has been not over $25 a stoker. From a large eastern steel-car concern comes this report: 'They have an average of 12 boilers in service at all times with a very steady load. They are operating at about 225% of rating for most of the 24 hrs., 7 days a week, with only two men on each shift. The repairs are very small, and they have no complaint to make on this matter whatsoever.'

"The Atlantic Sugar Refining Co., St. Johns, N. B., states, regarding its Taylor stokers, which have been in operation for 6 yrs.: 'The upkeep on these stokers has been very low, running between $60 and $70 per annum.'

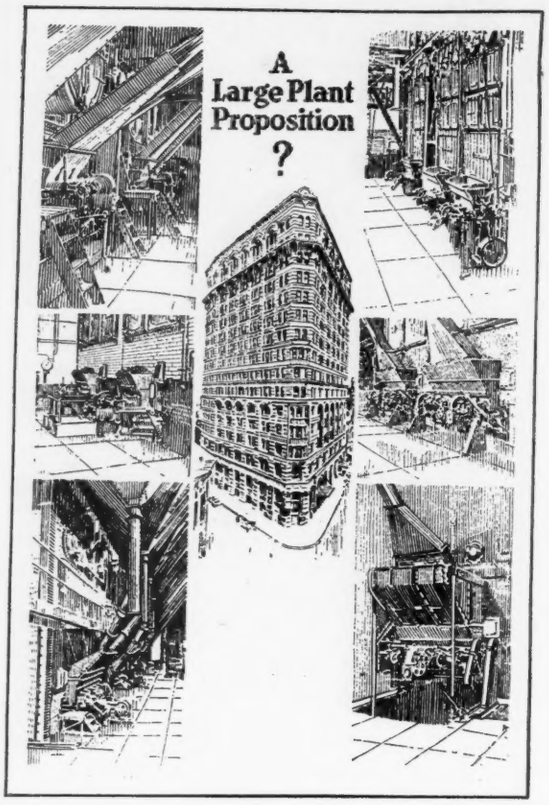
"The superintendent of a roller bearing plant states that his stoker repair costs have been $60 a year per stoker.

"There are so many similar cases that they can



Sectional View Showing Various Parts of a Taylor Stoker.

scarcely be regarded as exceptional, although in other cases, due to special conditions, upkeep is



Views Showing Stoker Installations in Small Power Plants.

This illustration taken from the booklet is intended to show definitely, by showing actual installations, that mechanical stokers are used with success in small plants as well as in the larger ones.

higher. Before the war a fair average allowance for repairs was $0.10 per rated boiler horsepower per year."

TRANSFORMER TANKS OF COPPER-ALLOY STEEL.

Resistance to Corrosion Adds to Life of Transformer and Helps to Insure Continued Service Under Adverse Atmospheric Conditions.

By R. V. BINGAY.

The use of copper-alloy steel for transformer tanks is a distinct step in advance in the manufacture of transformers. Copper-alloy steel, with its greatly increased life over plain steel, is of greater value in transformer tanks than under most conditions, owing to the fact that the tank incloses such a valuable product. That is, if the tank fails, thereby causing the failure of the transformer, the loss would be far greater than would be the case in the deterioration of a fence or almost any other thing for which sheet steel could be used. The length of life of this alloy steel has been proven by long, severe and conclusive tests to be five times that of plain steel.

Following is a quotation from D. M. Buck's paper entitled "A Review of the Development of Copper Steel":

"We may consider it as proven that by alloying with normal open-hearth or bessemer steel a small copper content (0.15 to 0.25%) the corrosion rate is enormously reduced wherever the products are exposed to alternate attacks of air and moisture. . . . A careful analysis of the author's results, as well as of the other data submitted, indicates that the increase in life of unprotected metal is probably more nearly 300 to 500%."

In addition to its rust-resisting qualities copper alloy steel has other advantages such as the better adherence of paint coatings, thus resulting in a more perfect and longer continued protection by the paint film. Also, it welds better, both with the electric arc and with the acetylene flame. The weld is softer and more homogeneous, the metal flowing better. The steel is also more easily fabricated, being softer and more ductile.

Extensive comparative life tests were made in the Pittsburgh atmosphere, and as similar atmospheric conditions would surround a great many industrial plants where large transformer installations are becoming more and more frequent the value of a transformer tank which is highly rust-resisting is of great importance in such installations. It has been found by actual experience that this material gives substantial protection against the action of smoke and acid fumes along with extremes of temperature and the corrosive influences of the weather. Elaborate, long continued, and carefully made tests by competent authorities would indicate that copper alloy steel is five times as rust-resisting as ordinary steel, and such steel used in transformer tanks would unquestionably increase the life of the tank in this proportion.

TABLE SHOWING CORROSION LOSS OF SHEET METAL EXPOSED TO ATMOSPHERE.

Time in months.	—Loss in ounces— Copper-alloy steel.	Plain steel.
1	0.52	0.90
2	0.64	1.82
3	0.95	3.00
4	1.13	3.64
5	1.13	4.41
6	1.17	5.53

An accompanying table shows figures taken in an actual test, and gives the corrosion losses in ounces per square feet of copper steel and plain steel. Test pieces were exposed for from 1 to 6-mo. periods in the Pittsburgh atmosphere, with the losses shown in the table, six pieces having been exposed at the start and one taken down at a time at the end of each month. From these figures it will be noticed that the progress in rusting under the original rust coat is much more rapid in the case of the plain steel than in the case of the copper-alloy steel. It is of great interest to note that corrosion practically stopped in the case of the copper-alloy steels after the fourth month. The rust had formed an efficient protecting coating.

Dr. Wm. H. Walker, Massachusetts Institute of Technology, says: "I do not know of a single instance in which a copper-alloy steel has not outlasted every other type of commercial iron or steel available." Copper alloy-steel used in transformer tanks will unquestionably add to the safety of the installation and increase the life of the tanks, particularly in locations where atmospheric conditions are bad, containing smoke, acid fumes, etc.

COMMERCIAL PRACTICE

New Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

PROGRESS OF CALIFORNIA UTILITY CUSTOMER-OWNERSHIP WORK.

Wide Distribution of Stock Among People in Territory Served Adds Strength to Position of Southern California Edison Co.

Immediately following authorization of the Railroad Commission for the sale of an additional $10,000,000 par value of its common capital stock, the Southern California Edison Co. on January 24 of this year actively resumed its campaign to distribute its stock among the people in the territory served. In a period of exactly 4 mo. down to May 24 the total sales have reached the high figure of $6,634,800 par value to 8823 subscribers, being an average of 7.5 shares or $750 par value purchased by each subscriber. The campaign is actively continuing and being handled entirely through the company's organization with its 5200 employes. Each geographic district and each department have been alloted quotas, with the result that keen friendly competition prevails and all employes are stock salesmen. Incidentally, several prizes for best results have been offered and a small commission is allowed employes for sales, but, according to A. N. Kemp, vice-president in charge of finance, these considerations are minor as compared with the spirit of constructive service which is behind the movement. The company officials have been attending evening meetings to the extent of three or four evenings each week, all through the territory where the company operates, encouraging the employes in their work and giving new thought and inspiration to the program.

"Realizing that the widest distribution of our stock can best be obtained by having a large number of our employes understandingly and enthusiastically working on stock sales," said Mr. Kemp, "we have been careful to thoroughly explain the needs for power development and the benefits of customer-ownership. We all recognize that the proceeds from the sales of our stock go into new water power development, increasing production, conserving the natural resources and encouraging thrift, and this has aroused a spirit of national patriotism among our forces. We know that the future growth and prosperity of our state of California depends upon rapid development of water power, that our community growth in Southern California and the San Joaquin Valley is being enhanced by the rapid increase along the lines of industrial and agricultural development, both absolutely dependent upon an adequate supply of water power. We all appreciate the added strength of the company's position in the territory it occupies which results from the wide distribution of our stock among the people at large throughout the territory in which we operate. This stimulates a keen personal interest in the building up of our company's business, particularly amongst our employe stockholders of whom we number over 80% of our permanent employes.

"The result of the large sales in the past 4 mo. has been to increase the number of the company's stockholders to 13,255 of whom over 11,000 are in the territory served. This affords an interesting contrast to the number of stockholders in 1917 when we first undertook the distribution of our stock at home. At that time we had 1864 stockholders of whom but 600 were residents of Southern California. Included in our present stockholders, the company numbers 2694 employes who are purchasing on an installment plan $4,927,700 par value of stock. Heretofore, the primary aim of utilities desirous of placing their securities with the people in the territory served has been to sell stock and the wide distribution of the stock has been of secondary importance. The Southern California Edison Co. was probably the first in the country to definitely reverse this program and base its campaign on securing stockholders and more stockholders with the result that the amount of stock sold took care of itself. Many of our railroads and industrial corporations number their shareholders by tens of thousands and it is our ambition to put the Southern California Edison Co. among the country's leaders in the number of stockholder-partners."

POLICY ADOPTED BY EDISON COMPANY BENEFITS PUBLIC.

Folder Describes How Commonwealth Edison Co., by Efficiency and Economy, Came Through War Period Without Increasing Rates.

In a 4-page folder bearing the title, "Through the War Without Increasing Our Rates," the Commonwealth Edison Co., Chicago, gives some interesting data on how it was able to come through the war and the post-war period of mounting costs without cutting its dividends to stockholders, without letting its service run down and without increasing its rates. The matter contained in the folder is reproduced herewith:

The Commonwealth Edison Co. took on practically 60,000 new customers in 1920. That number of new customers, added to the company's lines in a single year equals the total number of all customers for electric service, on the average, in cities of around 500,000 population—cities like Buffalo and San Francisco.

For 20 yrs. the company has been breaking its own records in this respect. In 1900 the new customers taken on numbered 2500, and that was considered a good year's work. But year by year, as the company developed and exploited the advantages of electric service in its various forms the number of new customers taken on annually rose by leaps and bounds to more than 12,000 in 1910, to 40,000 in 1914 and so on up to the astonishing number of 60,000 in 1920.

There you have the key to many facts which have contributed to the unique position of the Commonwealth Edison Co. in the electrical industry. To take care of the new business that was being continually added in such volume during the double decade referred to, the company had to be constantly adding to powerhouse generating capacity and to substation and transmission line distributing facilities. In making these additions two objects were constantly in mind: (1) Not merely ample, but liberal, provision for the increasing business of the future, and (2) the utmost of economy in operation that could be attained by utilizing the latest developments in the industry on a large scale. This policy has given the company always ample facilities for serving the annual influx of new customers, and has contributed much to frequent revision of its rate schedules always downward; never upward.

In 1900 the company's investment in property required for carrying on its business amounted to an average of $967 for every customer served. That is, for every customer on the books there was an average of $967 invested in generating stations, substations, transmission lines and other equipment and the rates charged for service had to be high enough to produce an average of net earnings per customer sufficient to pay a return on that $967. As the number of customers increased, and as the company strove for economical production, this investment per customer was reduced.

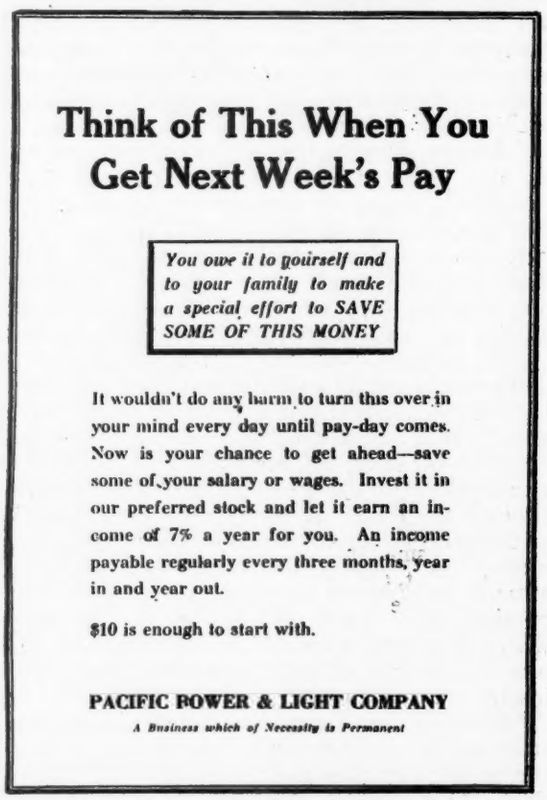
It has been the policy of the company always to keep its rates at the lowest point consistent alike with maintenance of its property and service, and with adequate return to its stockholders. As the number of customers increased and the investment per customer declined, and as economies in operation were effected, a proportionate share of the savings always went toward reducing rates. Thus the history of the company shows a succession of rate reductions voluntarily put into effect as a regular feature of company routine.

Now, do you begin to see why the Commonwealth Edison Co. was able to come through the war and the post-war period of mounting costs without cutting its dividends to stockholders, without letting its service run down and without increasing its rates? By consistent pursuit of the policy that has been only barely outlined in the foregoing, the company was in an exceptional position to meet the war-time conditions with a minimum of disturbance in its affairs. Because of liberal provision for future growth it had new and economical plants and equipment just going into service when the war came. It had ample generating capacity and distributing facilities in reserve for the new business demands of a considerable period in the future. Material rate reductions had recently been put into effect.

Consequently, when prices of labor, material and all other costs began to climb the economies which had been previously applicable to reducing rates became available for meeting the rising costs of operation. At the same time the management took steps to speed up its organization for the war emergency and to "cut the corners" in operating details wherever efficiency could be increased, labor and material saved, or a nonessential eliminated. The company's ownership of its own coal mines was another economical factor, one important enough for a message like this all to itself; and there were others of which space limitations forbid mention. But the main point in the whole story of how this company came through the war without advancing its rates is this: When the emergency came the company simply drew on the latent strength stored up within itself by lifelong practice of preparedness. And the public reaped the benefit in unimpaired service without increase in rates.

CULTIVATING THRIFT HABIT AMONG UTILITY'S EMPLOYES.

The Pacific Power & Light Co., Portland, Ore., which at the close of 1920 was serving 31,170 customers with electricity, 7164 with water and had 9290 gas consumers, in its campaign to interest employes and customers in the advantages of investing in the preferred stock of the company prepared some publicity matter which would attract the attention of those whom it wished to reach, one such piece of publicity material being depicted in the accompany illustration.


Think of This When You Get Next Week's Pay
You owe it to yourself and to your family to make a special effort to SAVE SOME OF THIS MONEY
It wouldn't do any harm to turn this over in your mind every day until pay-day comes. Now is your chance to get ahead—save some of your salary or wages. Invest it in our preferred stock and let it earn an income of 7% a year for you. An income payable regularly every three months, year in and year out.
$10 is enough to start with.
PACIFIC POWER & LIGHT COMPANY
A Business which of Necessity is Permanent

Publicity Matter Utilized to Interest Public in Utility's Preferred Stock.

WATER BOARD OF NEW YORK CITY ISSUES REPORT.

The Board of Water Supply of New York City has just issued its report for 1920, or its 15th annual report. It comprises 109 pages with many illustrations and tables and includes the report of the chief engineer describing the development of the Schoharie watershed, Shandaken tunnel and Gilboa dam. In addition the Board has prepared a bulletin on the Catskill water supply of a general descriptive nature and profusely illustrated.

APPLIANCES and DEVELOPMENTS

New, Improved or Interesting Electrical and Mechanical Apparatus and Devices, and Applications of Equipment and Methods in Practice

Types of Control on A-C. Elevator Motors.

The two principal types of a control that are used with elevator motors are semimagnetic and fullmagnetic. In the former reversing is accomplished by a mechanically operated drum-type reversing switch, and in the latter by directional contactors controlled from a car switch installed in the elevator car. Generally, semimagnetic control is not recommended for car speeds exceeding 100 ft. per min. The General Electric Co., Schenectady, N. Y., has recently developed both types of control for use with slip-ring and high-resistance rotor squirrel-cage induction elevator motors.

Control for slip-ring type induction motors.—An accompanying illustration shows a typical 4-point full-magnetic control panel for a slip-ring type induction motor. The panel consists essentially of one safety line contactor, two mechanically interlocked "up" and "down" directional contactors, three accelerating contactors, a hand-reset overload relay, a reverse-phase relay and two control fuses. The number of accelerating contactors will vary with the size of motor, up to 10-hp. there will be three points acceleration, from 10 to 25 hp. four points acceleration, and from 25 to 40 hp. five points acceleration.

Elevator Controller for 11 to 25-hp., 3-phase Unit.

Current peaks during acceleration of slip-ring motors are lower with light and average loads than they are with heavy loads, and in elevator work the heavy loads are the exception to the rule. If current-limit acceleration is employed advantage cannot be taken of these lower accelerating peaks. In order to gain this advantage time-element acceleration is employed. To obtain this given time interval between the closing of accelerating contactors a flywheel-type interlock is utilized. This consists of an unbalanced free moving flywheel which is released upon closing of the contactors on which it is mounted. This permits the interlock to function, causing the next accelerating contactors to close. The time of operation can be set at approximately 0.5, 1.0, or 1.5 sec.

Upon movement of the car switch to the first point, either "up" or "down," the proper directional contactor is closed permitting the safety line contactor to close connecting the motor to the line with full resistance in the circuit. The closing of the safety line contactor releases the flywheel interlock mounted on it and permitting the first accelerating contactor to close which releases its interlock, etc., until the motor has accelerated up to full speed and is running with no resistance in circuit. This acceleration is automatic.

If for any reason the safety line contactor is accidentally stuck in the closed position there are electrical interlocks so arranged as to prevent either of the directional contactors from closing until the safety line contactor is first free. A reverse-phase relay provided with potential coils is supplied on all polyphase elevator panels. This relay prevents starting of the motor in case of phase failure or phase reversal, provided the difficulty is not between the relay and the motor terminals. Practically all building codes call for a phase-reversal relay with potential coils on polyphase a-c. elevator control panels.

The overload relay is of the 2-coil inverse-time-element type and protects against sustained overloads, but does not trip on the accelerating peaks. The overload relay may be omitted if not desired. The semimagnetic type of control panel is similar to the fullmagnetic, with the exception that a drum-type reversing switch is used instead of magnetically operated contactors for reversing the motor.

Control for high-resistance rotor squirel-cage type induction motors.—In the fullmagnetic control for high-resistance rotor squirrel-cage motors mechanically interlocked directional contactors are used instead of the drum-type reversing switch. These contactors are electrically interlocked with the safety line contactor to prevent closing in case the safety line contactor is stuck. There is, sometimes, objection to throwing the larger sizes of high-resistance squirrel-cage type of motor directly across the line. Therefore the General Electric Co. has developed a line of panels giving 2-point acceleration for this type of motor. The panel consists essentially of a safety line contactor, two mechanically interlocked directional contactors, and one resistance contactor controlled by a flywheel-type interlock mounted on the safety line contactor. On closing this shorts out the resistor used in series with the primary at starting. A reverse-phase relay, a hand-reset overload relay and two control fuses are also supplied as with the other type of panels.

This equipment often permits the use of squirrel-cage motors on elevators traveling at speeds from 100 to 150 ft. per min. These higher speeds would be undesirable if the motors were thrown directly across the line. For elevator speeds above 175 ft. per min., and for slower speeds where accurate landing is required, a 2-speed a-c. elevator motor is often used, the control for such motors being generally of the fullmagnetic type incorporating the safety features already mentioned.

Buffer and Grinder with Double Shaft Extension.

The "Valley" electric buffer and grinder, recently placed on the market by the Valley Electric Co., 3157 South Kingshighway, St. Louis, is a product made from standard parts of the "Valley" power motor. The main features of this machine are thus enumerated by the manufacturer:

"Valley" Buffer and Grinder on High Stand.

The complete line is ball bearing and dustproof and can be supplied with pulley to be used for power purposes, if desired, with only a slight increase in cost. Both the motor and stand are finished in black enameled paint with lettering in aluminum. The end plates are solid and the bearings are SKF ball, double row, self-cleaning. The motor has a liberal reserve capacity of power. It is stated that this outfit will do away with all noisy, heavy and in-the-way line shafting. Each machine has a double shaft extension threaded on both ends. On one end two 4-in. flanges and nut for

holding the wheel are provided, and on the other end a nut for holding the brush is placed. The spindle on the 31 frame is 0.75 in. diam., and on the 41 frame and larger the spindle is 1 in. diam. Both these diameters will accommodate standard wheels.

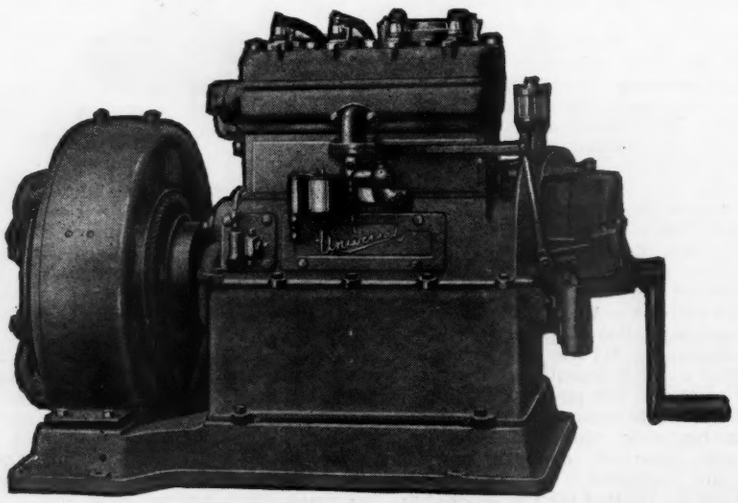
The "Valley" electric buffer and grinder is adapted for tire shops, machine shops, and for buffing, grinding or polishing. The motor is mounted on a heavy cast iron pedestal eliminating all vibration. The high stand is round, having a round base with three holes for lagging to the floor.

Generator Set Suitable for Small Installations.

An electric generator set for furnishing energy for lighting, wireless, cooking and searchlight purposes has been designed by the Universal Motor Co., Oshkosh, Wis. It is known as the "Universal" 4-kw. generating set, and being light in weight and compact it can be utilized for house lighting in isolated communities, motor yacht and other purposes where small installations are an advantage. The generator is direct connected to a 4-cycle, 4-cylinder "Universal" motor, developing from 9 to 12 hp., the armature taking the place of the flywheel, the entire plant weighing less than 600 lbs. The generator is of the en bloc type, 2⅝ bore by 4-in. stroke, with a speed of 1100 r.p.m The motor is equipped with a special governor which promotes smoothness of action and uniformity of speed; the governor is inclosed and runs in a bath of oil.

The manufacturer states that this generator set is being supplied to the U. S. Government and several foreign governments for use on motor patrol boats, motor repair trucks, etc. It is equipped with a special governor which directly controls the speed to produce a flickerless light. It is usually used without storage batteries, but where desired it may be connected with same and used for charging. The electric energy may also be used for power, running bilge and force pumps, and is convenient for cooking purposes. The "Universal" is supplied in 4-kw. capacity for operation at 60 or 110 volts.

It is claimed that moving-picture houses have found the "Universal" 4-kw. generator set suitable for their needs. Its absence of flicker and smooth operation aids in bringing out the full character of the pictures on the screen and in producing satisfactory work from the projector. In addition to the machine the "Universal" supplies energy for from 25 to 50 lamps of 60 or 110 volts.



"Universal" 4-kw. Generating Set.

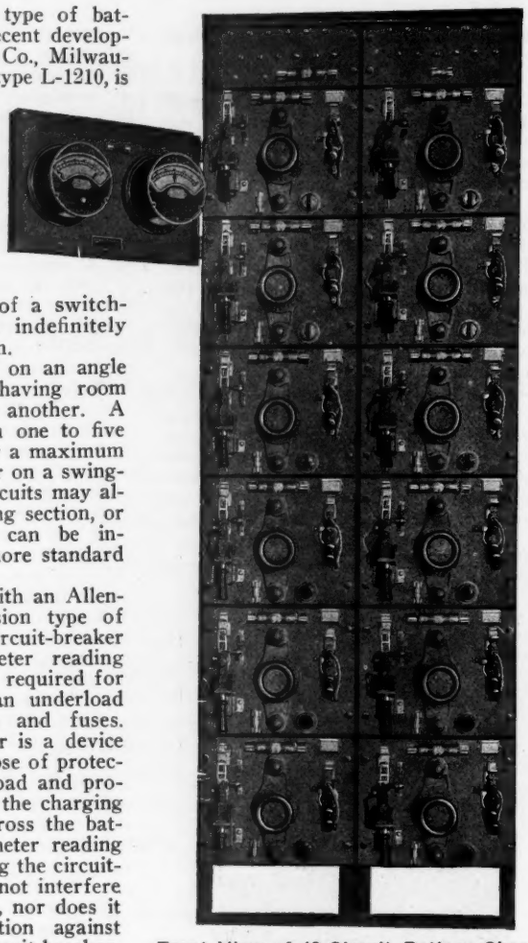
Battery Charging Boards for Electric Trucks.

A simple compact unit type of battery charging panel is a recent development of the Allen-Bradley Co., Milwaukee. This panel, known as type L-1210, is designed for charging tractor, truck and electric vehicle types of batteries and is made standard with a maximum continuous capacity of 100 amperes. In combination with any number of similar standard panels it is stated that the capacity of a switchboard may be increased indefinitely after the initial installation.

The panels are mounted on an angle iron frame, each section having room for six panels, one above another. A section might contain from one to five panels and a meter panel or a maximum of six panels with the meter on a swinging bracket. Additional circuits may always be added to an existing section, or the switchboard capacity can be increased by adding one or more standard section frames.

Each panel is equipped with an Allen-Bradley graphite compression type of rheostat, an overload circuit-breaker with voltmeter and ammeter reading contacts (only one meter is required for a complete switchboard) an underload circuit-breaker, pilot lamp and fuses. The overload circuit-breaker is a device that serves the double purpose of protecting the circuit from overload and providing a means for reading the charging current and the voltage across the battery of its circuit. The meter reading position is obtained by lifting the circuit-breaker handle, which does not interfere with the charging operation, nor does it interfere with the protection against overload offered by the circuit-breaker. An overload will interrupt the circuit even though the handle may be held up. The lifting of the handle transfers the charging current from the upper contacts to the lower contacts without interrupting the charging circuit, the contacts returning to the normal position when the pressure is removed. The same movement of the handle in reading the current also establishes a circuit for the voltmeter and the operator can obtain both meter readings at the same time.

The overload circuit-breaker is shown on the left of the panels in the illustration, the rheostat handwheel in the center and the underload breaker at the right. The underload circuit-breaker is closed by hand and in case of low current or voltage failure opens the circuit —which is not re-established without attention and investigation by the operator. A special discharging contact can be added to the lower end of the underload circuit-breaker arm. As many of the unit panels as may be needed for discharging purposes can be equipped with this feature. A busbar of a sectional type is used in the assembly of switchboards so that circuits can be added with a minimum of disturbance to the existing connections.



Front View of 12-Circuit Battery Charging Board.

Allis-Chalmers Manufacturing Co., Milwaukee, recently issued bulletin No. 1819 in which a few of the many types and designs of electrically operated hoisting equipments furnished by the company are illustrated and described. The bulletin has been compiled with the object of giving information to engineers, mine managers and those interested in hoisting equipment and to assist them in the selection of the type of hoist to meet their individual requirements.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Liberty Radio Club, Cumberland, Md., has construction under way on a radio station, comprising about 900 ft. of wire for the aerials.

P. & S. Electrical Supply Co. has leased space in the building at 136 West 23rd street, New York City, for a new local establishment.

C. H. Wheeler Manufacturing Co., Lehigh and 18th streets, Philadelphia, manufacturer of condensers, pumps, etc., has opened a branch office at 53 State street, Boston.

Electrical Engineers Equipment Co., 35 South Desplaines street, Chicago, manufacturer of line and station equipment, has issued a folder descriptive of its farm line switching and protective equipment.

New York Electric Installation Co., 147 West 35th street, New York City, has leased a 4-story factory, 26 by 100 ft., at 71 Eighth avenue, for a new works. The lease is for a term of years and totals $94,500.

Hudson Battery & Supply Co., Chicago, has purchased a 1-story building at 2856 Quinn street and plans to move from 155 North Market street to the Quinn street property which contains 26,000 sq. ft. of floor space.

Brown Instrument Co., Wayne and Windrim streets, Philadelphia, manufacturer of instruments for recording and indicating temperatures, pressure, speeds, etc., has opened a branch office at 201 Reliance Bank building, 1634 Euclid avenue, Cleveland.

Worthington Pump & Machinery Corp., North American building, Philadelphia, has been awarded a contract by the city for a new centrifugal pumping unit, to be installed at the Shawmont pumping station of the waterworks system, at a price of $102,000.

Multiple Storage Battery Corp., 350 Madison avenue, New York City, which was recently incorporated with a capital of $1,000,000, has acquired the business of the Multiple Storage Battery Co., and is building a large addition to its plant at Jamaica, L. I.

All-Steel-Epuip. Co., Aurora, Ill., has issued its catalog No. C-22 descriptive of its office and factory equipment, consisting of steel lockers, shelving cabinets, bench drawers, tool boxes, taper pans, shop boxes, stacking boxes, transfer cases and special equipment.

Manufacturing Equipment & Engineering Co., Framingham, Mass., has issued a number of loose-leaf folders illustrating and describing its sanitary drinking fountains, metal stools and chairs, sanitary washbowls and other equipment for shop, factory, office and general use.

Westinghouse Electric & Mfg. Co., Springfield, Mass., has commenced the installation of a wireless station at its local plant, and will establish similar plants at its works at Newark, N. J., and Cleveland, as well as at the main works at East Pittsburgh, Pa., for communication between the different plants.

Royal Forwarding Co., 24 Stone street, New York City, steamship broker and foreign freight contractor, has announced that it is in a position to supply exporters with lists of merchants in Reval, Esthonia, Riga and Latvia who would be willing to dispose of American merchandise in those countries.

Triumph Electric Co., Cincinnati, manufacturer of the "40° Triumph" a-c. and d-c. motors and generators, has moved its Chicago office into more spacious quarters at 2814-16 Wentworth ave. The old office at 628 West Lake street was fast becoming inadequate for the rapidly expanding business in this territory which is so efficiently served by Manager W. R. Bonham.

Esterline-Angus Co. is the successor to the Esterline Co., engineer and manufacturer of graphic meters, permanent magnets, etc., Indianapolis, Ind. The Esterline Co. was organized by J. W. Esterline in 1900 and was incorporated in 1906. In 1910 D. J. Angus became associated with Mr. Esterline and in 1917 he became a stockholder and director of the company.

Automatic Electric Heater Co. is now getting into production in its plant in Warren, Pa. The new buildings are L shaped, approximately 100 ft. long by 60 ft. wide, and have several times the area formerly available, and in addition there is ample room for future expansion. The company is now making, in addition to four sizes of "Sepco" water heaters, an automatic electric glue pot and a new electric vulcanizer.

Pawling & Harnischfeger Co., Milwaukee, has announced that its San Francisco office has been moved from the Monadnock building to 32 Beale street, where the company maintains a complete service station warehouse and display room for cranes and hoists, machine tools and excavating machinery. R. M. Taylor, district manager for the Pacific Coast, has his headquarters now at the Beale street address. J. MacFerran Taylor is a new member of the Pacific Coast sales district.

Ridgway Dynamo & Engine Co., Ridgway, Pa., has issued a new bulletin No. 29 covering its "Unaflow" engines, which it is stated are built under the Stumpf patents combining the "Unaflow"" principle with steam jacketed heads and double beat poppet valves. As thus constructed it is claimed that this engine is very efficient on condensing service, particularly when used at the higher steam pressures and superheats which are becoming more common in stationary engine practice. The bed, governor, reciprocating parts and other details, except the cylinder, valves and valve gear, are the same as have been used for many years on the Ridgway side crank, single and 4-valve engines.

Pittsburgh Crane & Equipment Co., Pittsburgh, has recently issued an 8-page booklet illustrating and describing its electric traveling cranes. Full data are given as to the various sections and parts of the cranes and a number of the illustrations are of actual installations.

International Time Recording Co., 50 Broad street, New York City, manufacturer of time-recording devices, has issued a 20-page booklet entitled "Electric Time Recorders," which illustrates and describes a number of the electrical devices and accessories manufactured by the International company.

General Electric Co., Schenectady, N. Y., has taken over the electrical manufacturing company of Societa Elettrotecnica Galileo Ferraris, Milan, Italy, previously known as the Thomson-Houston Co. The electrical branch will be separated from the steam manufacturing end of the business and placed under separate management.

Harris Brothers Co., 35th and Iron streets, Chicago, has recently issued the following printed matter: General catalog No. 183 representing its full line of regular Chicago stock equipment; industrial bulletin No. 204 for manufacturing and industrial concerns; water tube boiler book No. 505 describing a number of new boilers which the company purchased from the Government; catalog SL No. 1, Slidell shipyard catalog; catalog No. NS-1, National shipyard catalog; Camp Shelby material catalog and Gerstner Flying Field Camp catalog.

Greenfield Tap & Die Corp, Greenfield, Mass., manufacturer of gages, screw-cutting tools, reamers, pipe and machine tools, has announced that at a recent meeting of its board of directors it was voted to purchase the entire capital stock of the Greenfield (Mass.) Machine Co., manufacturer of cylindrical and universal grinders, and the Morgan Grinder Co., Worcester, Mass., manufacturer of internal grinders. The combination of the Morgan Grinder Co., and the Greenfield Machine Co., together with the machines now produced by the Greenfield Tap & Die Corp., will constitute the machine division of the latter concern, which will operate both plants in their present location, although eventually the Worcester plant will be moved to Greenfield. The organization of both plants will remain the same.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

E. J. CONDON, JR., has been appointed assistant general manager of the Intermountain Railway, Light & Power Co., Colorado Springs, Colo.

FRANK W. REYNOLDS, president of the engineering firm of Lockwood, Greene & Co., Boston, sailed for Rotterdam June 25 for a summer pleasure tour of Europe.

E. S. JONES, formerly assistant engineer of the Pacific Gas & Electric Co., Sacramento, Cal., is now connected with the Honolulu Gas Co., Honolulu, Hawaii, as engineer.

WARREN F. KENDRICK has been appointed sales engineer for the Griscom-Russell Co., 53 West Jackson boulevard, Chicago, manufacturer of heaters, evaporators, coolers and other specialties.

MISS SARAH M. SHERIDAN, sales manager of the Detroit Edison Co., Detroit, for many years, and in active charge of its commercial department, has been elected a vice-president of the company.

E. C. STONE, assistant to the general manager of the Duquesne Light Co., Pittsburgh, was elected secretary-treasurer of the Pittsburgh Section of the American Institute of Electrical Engineers, at a recent meeting of the organization.

J. O. G. GIBBONS, formerly with Westinghouse, Church, Kerr & Co., and now engaged in private practice, has joined forces with C. E. Brown, forming a partnership under the name of Gibbons & Brown, Ordway building, Newark, N. J., to conduct a business as consulting engineers specializing in power plants and industrial problems.

F. C. HENDERSHOT, who for a number of years has been a representative of the Sterling Bronze Co., Cassidy & Sons Co., and the Wahle-Phillips Co., has joined the sales force of the Beardslee Chandelier Manufacturing Co., 216 South Jefferson street, Chicago, to cover its Southern territory. Previous to his traveling experience, Mr. Hendershot was engaged in the retail distribution of lighting equipment in Pittsburgh.

PROF. ROBERT PEELE, of the Columbia University School of Mines, has been elected an honorary member of the Institution of Mining and Metallurgy, London, "in recognition of his eminent services in the advancement of mining science and education." As an author Professor Peele is internationally known. He has been a frequent contributor to technical journals and has written on mining subjects for the *Encyclopedia Britannica*. In 1907 his book on "Compressed Air," widely used by both engineers and students, was brought out and is now in its fourth edition. The honorary list of the Institution of Mining and Metallurgy of London contains the names of two other Americans, the late Rossiter Worthington Raymond and Henry Marion Howe. The Institution was founded in 1892. Its membership is composed chiefly of engineers interested in the mining and metallurgy of the nonferrous ores and metals. Professor Peele has been a member since 1894.

J. R. ONG, who was recently appointed transportation engineer of the Georgia Railway & Power Co., Atlanta, Ga., was graduated from Purdue University in 1909. His practical railway experience began in car shops and power plants during the construction and early operating period of the Indianapolis & Cincinnati Traction Co. and the Chicago, Lake Shore & South Bend Railroad Co. After graduating he became an apprentice in the East Pittsburgh (Pa.) works of the Westinghouse Electric & Manufacturing Co., being later transferred to the Philadelphia sales office of the company. In 1911 he became superintendent of substations for the Fort Dodge, Des Moines & Southern Railway Co. In December, 1911, Mr. Ong accepted an appointment as electric railway engineer on the joint engineering staff serving the Railroad Commission of Wisconsin and the Wisconsin Tax Commission. In this position he specialized on transportation matters and made extended studies for the Railroad Commission relating to operating matters and service on the electric railways of Wisconsin. After serving with the Wisconsin Commission for some time he resigned to accept the position of traffic engineer for the Board of Control of the Kansas City (Mo.) Railways Co., resigning that position in 1918 to become transportation engineer with the Winnipeg Electric Railway Co., Winnipeg, Can.

J. R. Ong.

OBITUARY.

ALBERT C. SCHWEIZER, Brooklyn, N. Y., electrical engineer, died at his home, 564 53d street, recently, aged 42 yrs.

WILLIAM CARTMAN, York, Pa., general manager of the York Electrical Machine Works, died recently at his home on West Jackson street, aged 38 yrs.

E. E. HUDSON, president of the Waterbury (Conn.) Battery Co., died June 27, aged 42 yrs. He had been identified with the electrical industry for many years and was at one time vice-president of the Edison Storage Battery Co.

JOHN C. MCMYNN, of Chicago, who was widely known as a consulting engineer, died recently. He supervised the Ferris wheel during the World's Fair in Chicago, and was consulting engineer for the state institution of Wisconsin and chief inspector for the Robert W. Hunt Co., manufacturer of steel products.

CHARLES A. PROUTY, former member of the Interstate Commerce Commission, died at his home in Newport, Vt., July 8. He was a member of the Commission for 18 yrs. until February, 1914, when he was appointed director of valuation. In 1918 he was appointed director of the division of public service and accounting of the Railroad Administration.

JOHN F. WALLACE died July 3 in Washington, D. C. He was born in Fall River, Mass., Sept. 10, 1852, and was graduated from the University of Wooster as a civil engineer. He was identified for years with railroads, notably with the Illinois Central from 1891 to 1904, or until he became connected with the Panama Canal. From 1906 to 1917 he was first president and then chairman of the board of Westinghouse, Church, Kerr & Co.

CHARLES KINTNER, formerly a patent expert of New York City, died at his home in Ann Arbor, Mich., July 7. During the many years he lived in New York City he had maintained a home in Ann Arbor, to which he returned each summer. Mr. Kintner was one of the acknowledged authorities on patents in the United States and was active and successful in urging improvements in Patent Office facilities some 30 yrs. ago, and handled many important electrical patents of those early days.

ALBERT TAYLOR, New York district manager of the Electric Storage Battery Co., died unexpectedly July 6 from hemorrhage of the brain. He was the youngest son of the late Rev. William M. and Jessie Steedman Taylor and was born Feb. 6, 1864, in Liverpool, England. He was graduated from Princeton University with the class of 1884 and served an apprenticeship with the Edison Co., being afterwards associated with the United States Electric Co. In 1898 he joined the sales department of the Electric Storage Battery Co. and was with this firm continually until his death. Mr. Taylor possessed a very wide acquaintance in the electrical field, with which he had been identified for 35 yrs. The funeral services were held July 8 at the home of the deceased in New Rochelle, N. Y.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES

Calais, Me.—The Maine Central Railroad Co., 222 St. John street, Portland, Me., will install considerable electrical equipment in connection with the rebuilding of its locomotive repair shop, 50 by 200 ft., at Calais, recently destroyed by fire.

Winthrop, Me.—The Bailey Oil Cloth Co. has commenced the rebuilding of its plant recently destroyed by fire, and in connection with the work will erect a new power house. Electrical equipment will also be installed in the factory.

Epping, N. H.—Equipment at the plant to be erected by the Overland Shoe Co., will be electrically operated, and considerable with individual motor drive. Local commercial service will be used. The factory is estimated to cost $30,000.

Malden, Mass.—Electrical equipment will be installed in the 4-story plant addition to be erected by the Malden Knitting Mills, 62 Franklin street, estimated to cost $75,000.

Worcester, Mass.—The Worcester Electric Light Co. has plans under way for the erection of a machine shop, 60 by 70 ft., at its power plant on Webster street, estimated to cost $20,000.

Worcester, Mass.—Considerable electrical and mechanical equipment will be installed in the assembling plant to be established by the Worcester Automatic Sprinkler Co., recently incorporated with a capital of $150,000. The company has secured property at 60 Ellsworth street for the proposed works. Frank P. Ryan is president.

Ansonia, Conn.—Considerable electrical apparatus will be installed in the 2-story plant to be erected by the Ansonia O. & C. Co., at its local textile works, estimated to cost $125,000.

Hartford, Conn.—Considerable electrical equipment will be installed in the 3-story building and printing plant to be erected on High street by the Graphic Arts Co., 74 Union place, estimated to cost $80,000. Buck & Sheldon, Inc., 60 Prospect street, is the architect.

Waterbury, Conn.—The board of directors of St. Margaret's school, Grove street, has plans under way for the erection of a power house at the institution. Clark, McMullen & Riley, 101 Park avenue, New York City, are engineers.

Albany, N. Y.—A 1-story power house will be erected by the Hires-Turner Glass Co., 30th and Walnut streets, Philadelphia, in connection with its new plant on Tivoli street, Albany, estimated to cost $100,000.

Batavia, N. Y.—The Genesee Light & Power Co. is perfecting plans for the erection of an addition to its electric plant at Attica, Wyoming County, for extensions in local service. Application for permission to do the work has been made to the Public Service Commission.

Brooklyn, N. Y.—A central power house, ice and refrigerating plant and other mechanical buildings will be erected by the Ashland Contracting Co., 186 Remsen street, in connection with the construction of its industrial project on Fulton street, Jamaica, L. I., to consist of a central market building, light manufacturing plants and other structures. The entire project is estimated to cost $1,500,000. Michael H. Wolpert is president of the company, which was recently organized, and Herman Froeb, treasurer.

Buffalo, N. Y.—Considerable electrical equipment will be installed in the filtration plant now proposed by the City Council, with cost estimated at $4,000,000. Tentative plans are being developed.

Granville, N. Y.—The Telescope Cot Bed Co., 535 East 79th street, New York City, will construct a power house in connection with its new plant at Granville, estimated to cost $100,000. Russell G. Cory, 50 Church street, New York City, is engineer.

Herkimer, N. Y.—The Herkimer Municipal Commission has been granted permission by the Public Service Commission to construct an addition to its municipal electric lighting system.

Long Island City, N. Y.—The Loft Candy Co., Broome and Centre streets, New York City, has awarded a contract to the Barney-Ahlers Construction Co., 110 East 40th street, New York City, for the erection of the proposed 1-story power house at its local plant on Hamilton street.

New York, N. Y.—A 1-story switch house, estimated to cost $125,000 with equipment will be erected by the New Amsterdam Gas Co., 132 East 15th street, at 401 East 40th street. William Whitehill, 12 Elm street, is engineer.

New York, N. Y.—The New York Edison Co. will furnish service for the National Association Building Corp. offices at 59 West 46th street, comprising the former Hotel Wen worth, and now being remodeled. The structure is 10-story. The installation will consist of 2500 lamps and electric elevator equipment.

New York, N. Y.—The New York Edison Co., 130 East 15th street, will soon take bids for the erection of its proposed 2-story substation at 224-26 East 52nd street, to be 40 by 100 ft.

New York, N. Y.—Considerable electrical and mechanical equipment will be installed in the 2-story automobile service building to be erected at 410 East 30th street by the Inter-City Fuel Co., 17 Battery place, and estimated to cost $50,000.

New York, N. Y.—Electrical and mechanical equipment will be installed in the 1 and 2-story repair works to be erected by the New York & Harlem Railroad Co., 1874 Second avenue, at 2155 Madison avenue, estimated to cost $50,000.

Boonton, N. J.—The Board of Aldermen has arranged for an appropriation of $100,000 for extensions and improvements in the municipal water system, the work to include the construction of an electrically operated pumping plant in the Sheep hill section. Frederick V. Pitney, 21 South street, Morristown, N. J., is engineer.

Lakehurst, N. J.—Considerable electrical and mechanical equipment, including five monorail cranes, will be installed in the aircraft hangar now being erected here by the Bureau of Yards & Docks, Navy Department, Washington, D. C. The structure will be 264 by 803 ft., and 195 ft. high.

Newark, N. J.—Considerable electrical equipment will be installed in the building to be erected by the local chamber of commerce at Branford and Treat places, estimated to cost $1,000,000. A campaign to raise a fund of this amount has been placed under way.

Newark, N. J.—Electrical and mechanical equipment will be installed in the plant to be erected by the Vreeland Motor Co., Chestnut street, Irvington, on Coit street, Hillside section, including motors, controllers, light and power equipment, etc. The first unit of the plant is estimated to cost $350,000. John T. Simpson, Essex building, is the engineer.

Newark, N. J.—The American Street Lighting Co., a Delaware corporation, has filed notice of organization to operate in New Jersey. M. M. Stallman, 810 Broad street, is local representative.

Trenton, N. J.—Electrical equipment will be installed in the 4-story plant to be erected on East State street by the Trenton Poster Advertising Co., estimated to cost $100,000.

Wilmington, Del.—The City Council has approved an appropriation of $15,000 for improvements in the municipal fire alarm signal and electrical service. The work will be handled by the recently organized Department of Public Service.

Dushore, Pa.—The Sullivan County Electric Co. has made application to the Public Service Commission for charters for new electric companies to operate as subsidiary organizations at Laceyville, Forkston township, Meshoppen Borough, Mehoopany township, Washington township,

Windham township, Powell, Monroeton and vicinity. It is said that the application is preliminary to extensive electrical development in these sections.

Bakerstown, Pa.—The Pittsburgh Cut Flower Co., 116 Seventh avenue, Pittsburgh, will commence the immediate erection of the superstructure of its new power house at Bakerstown, foundation work for which has recently been completed. It will be 1-story, 42 by 73 ft., and is estimated to cost $50,000.

Harrisburg, Pa.—The Harrisburg Light & Power Co. has filed notice of increase in debt from $3,597,000 to $3,632,000.

Hazelton, Pa.—The Consolidated Telephone Co. of Pennsylvania is planning plant improvements and extensions at Hazleton, Wilkes-Barre, Carbondale, Scranton, Reading and Allentown, estimated to cost $80,000. A new 100-line plant will be added to the exchange station at Hazleton.

Linglestown, Pa.—Electrical and mechanical equipment will be installed in the vocational school to be erected by the Lower Paxton Township School Board on a site near Linglestown, with cost estimated at $50,000. Frank G. Fahnestock, Patriot building, Harrisburg, Pa., is architect.

New Cumberland, Pa.—Following the application for charters for 16 new electric light and power companies to operate in New York and Adams counties, and ultimately to be merged with the New Cumberland Valley Light & Power Co., protest against the incorporation of three of the companies has been made to the Public Service Commission by the Musselman-Butler Electric Co., claiming rights in the territory in which the new organizations propose to operate.

Northampton, Pa.—The Pennsylvania Power & Light Co., Allentown, has opened a new local branch office and display quarters at 2155 Main street. Howard Lindaman will be local manager in charge.

Philadelphia, Pa.—Electrical equipment will be installed in the repair shop to be erected by the Cramp Ship & Engine Building Co., on Fletcher street, estimated to cost $30,000.

Philadelphia, Pa.—The Pennsylvania Sugar Co., 1037 North Delaware avenue, has filed plans for extensions and improvements in the power house at its works to cost $15,000.

Philadelphia, Pa.—The board of directors of St. James' Mercy Hospital, Chester, Pa., has completed plans for the erection of a power house at the institution, the work to be carried out in connection with the construction of a main building.

Philadelphia, Pa.—Considerable electrical equipment will be installed in the knitting mill to be erected by Sheplan, Sabul & Palmer, 15th and Wallace streets, manufacturers of knit goods, at 43rd street and Lancaster avenue, estimated to cost $150,000.

Towanda, Pa.—The Towanda Gas & Electric Co. has made application to the Public Service Commission to organize two subsidiary companies, to be known as the North Towanda and Wysox Electric companies.

Pittsburgh, Pa.—Electric equipment will be installed in the 3-story plant to be erected by Danovitz Brothers, 824 Carpenter street, manufacturers of barrels. It will be 45 by 100 ft., located on Reedsdale street.

Annapolis, Md.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded a contract to the Donnell-Zane Co., 4002 Woolworth building, New York City, for the erection of new towers at the local radio station to cost $95,645.

Baltimore, Md.—Plans have been approved by the Chesapeake & Potomac Telephone Co. for an appropriation of $474,695 for extensions and betterments in its plants and system in this district. The proposed work will be carried out during the summer. A number of new lines will be constructed, including overhead and underground installations.

Cumberland, Md.—The City Council has authorized the installation of a new "white way" street lighting system on Virginia avenue. Property owners have agreed to defray the expense. Equipment will be purchased at once.

Buckhannon, W. Va.—The Buckhannon Light & Water Co. has construction under way on a new power plant. Enoch Bellis is president.

Kingwood, W. Va.—The West Virginia & Maryland Power Co., recently organized by Carleton C. Pierce, Kingwood, has surveys under way for a large power project in this section. It is proposed to construct a large central generating station, with transmission and distributing lines extending to different communities in West Virginia and Maryland. The project is estimated to cost $3,000,000.

Winston-Salem, N. C.—Claude Alexander is interested in establishing an electric light plant.

Chesterfield, S. C.—The Teal Light & Power Co. is planning the rebuilding of its local power house recently destroyed by fire.

Rock Mart, Ga.—The Common Council is planning a bond issue of $15,000 for the installation of an electric lighting system.

Bronson, Fla.—The Bronson Manufacturing Co. is planning the construction and operation of a local electric plant for general light and power service. B. B. Stokes is secretary.

Brooksville, Fla.—The Evans Light & Ice Co. has been incorporated with a capital of $25,000 to operate a local electric light and power system. W. D. Evans is president, and T. H. Evans, secretary and treasurer.

Florida City, Fla.—C. B. Clinton, acting town clerk, will issue $30,000 light and street bonds.

Green Cove Springs, Fla.—The city may vote on $150,000 bonds to improve and construct additions to the electric light and power plant and make sewerage and paving improvements. Address the mayor.

Miami, Fla.—The Miami Electric Light & Power Co. is planning the installation of additional machinery at its local power plant. H. H. Hyman is manager.

Orlando, Fla.—The City Council has preliminary plans under way for the establishment of a municipal electric light and power plant. Consideration is being given to the acquisition of an existing plant, and in such event, bonds for $1,500,000 are contemplated for the purchase and for proposed improvements and extensions. Address Mayor Duckworth.

St. Petersburg, Fla.—The Grove Land & Timber Co., of which E. W. Grove, Asheville, N. C., is president, plans the installation of an electric light and power plant in connection with the development of an 11,000-acre farming site.

Wauchula, Fla.—J. G. Fancy, Fort Meade, Fla., and associates are organizing a company to erect an electric light, ice and cold storage plant to cost $200,000. It is proposed to furnish electricity to Wauchula, Zolfo, Bowling Green and Fort Meade.

NORTH CENTRAL STATES.

Lima, Ohio.—The City Council is disposing of a note issue of $135,000, the proceeds to be used for the installation of a street lighting system in important districts.

Wooster, O.—The city plans the installation of a "white way" system of street lamps on several streets. Address H. H. Miller, director of public service, City Hall.

Onaway, Mich.—Property occupied by the Onaway Light & Power Co. was destroyed by fire, June 28, with loss estimated at $25,000.

Champaign, Ill.—The Commercial Light Co. of Chicago has secured the contract for the installation of a complete boulevard lighting system in what is known as the University District, an area eight blocks square adjacent to the University of Illinois. Approximately 550 lamps will be installed with metal standards and round globes at a distance of from 75 to 80 ft. apart. The contract price was $76,958.27, which was $3,611.27 less than the lowest competitive bid. The highest bid was $195,834. The lighting system is to be completed by Home-Coming Week in October.

Flora, Ill.—Bids will be received July 18 by the city council, T. J. Clark, clerk, for furnishing material and construction improvements to the municipal electric light and power system. Fuller & Beard, engineers, Chemical building, St. Louis.

Pekin, Ill.—The Pekin Light, Heat & Power Co. has applied to the Illinois Public Utilities Commission for permission to construct a new power line from what is known as the Rockford power house in Pekin to South Pekin.

Rockford, Ill.—Bids were received July 9 for the purchase of poles and material for the installation of 64 new arc lamps in accordance with the specifications. Address Elmer O. Strand, city clerk, City Hall.

Crookston, Minn.—The city will extend the electric light and power service to Alverado and Newfolden. Address city clerk.

Hopkinton, Ia.—The Hopkinton Electric Light & Power Co. has completed plans for the erection of its

proposed hydroelectric power plant, estimated to cost $35,000. Holland, Ackerman & Holland, 122 North 4th avenue, Ann Arbor, Mich., are engineers. W. Z. Millroy is president.

Corning, Ia.—Bonds to the amount of $60,000 have been voted for a municipal light and power plant. Address C. K. Mums.

Chillicothe, Mo.—The City Council has awarded contracts for extensions and improvements in its electric plant and system, including the installation of considerable new equipment. E. E. Harper, 3031 Park avenue, Chillicothe, is engineer.

Columbia, Mo.—A power plant is to be erected at the University of Missouri. Address Board of Trustees.

Lebanon, Mo.—J. B. Quigley and associates have preliminary plans under way for the establishment of a new hydroelectric generating station for municipal service on the Niangua river, in the Linn creek section.

Lexington, Mo.—The Missouri Gas & Electric Co. contemplates constructing a transmission line for electric current from Liberty to Lexington, Mo.

Lutesville, Mo.—Claude Alexander and associates are planning the establishment of a new local electric lighting plant. A similar station is also contemplated at Marble Hill, Mo.

McPherson, Kan.—The Muncipal Electric Light and Water Works plan to install a new 500-kw. generating unit this fall or the first of next year. Address Henry Fox, chief engineer.

Pawnee City, Neb.—The Common Council will commence work at once on the remodeling and improving of its municipal electric lighting plant, estimated to cost $80,000. H. D. Flory is city clerk.

SOUTH CENTRAL STATES.

Hickman, Ky.—Henry Ford, Detroit, Mich., is reported as planning the construction of a dam on the Mississippi river between Dorena and Hickman.

Birmingham, Ala.—The Alabama Power Co. has been granted permission by the Federal Power Commission to construct and operate its proposed new hydro-electric generating plant at Duncan's Riffle, near Verbena, on the Coosa river. Work will be placed under way at once and will require about 24 months to bring to completion. The plant will have an initial capacity of 60,000 hp., with ultimate output of 120,000 hp., and is estimated to cost $6,000,000. Thomas W. Martin is president.

Starkville, Miss.—The Common Council has arranged for the sale of a bond issue of $25,000 for the installation of a local electric system.

Hugo, Okla.—The local chamber of commerce is perfecting plans for the construction of its proposed series of hydroelectric plants in this section and will make application to the Federal Power Commission, Washington, D. C., for permission to build the structures at an early date. The sites being selected include Mountain Fork, with plant to be of 150,000 hp. capacity; Little river, 100,000 hp.; and on the Kiamichi river, 50,000 hp.

Kiowa, Okla.—The Borough Council has approved a bond issue of $15,000 for the construction of a power line from Kiowa to Amorita, Okla. W. B. Rollins & Co., 209 Railway Exchange building, Kansas City, Mo., are engineers.

Oklahoma City, Okla.—More than 1 mi. of North Broadway, including automobile row, will be lighted by a "white way," comprising 112 lamps of 600 cp. each, if plans launched by business men of the city are carried out. Address city clerk.

Sayre, Okla.—The Common Council has approved a bond issue of $75,000 for extensions and improvements in its municipal electric plant and system. W. Benjamin Turner is chairman of the city commission.

Sayre, Okla.—The Common Council is completing plans for the proposed extensions and improvements to be made at the municipal electric power plant, estimated to cost $35,000. V. V. Long & Co., Colcord building, Oklahoma City, Okla., are the engineers.

Cross Plains, Tex.—The Cross Plains Light & Power Co. has been incorporated with a capital of $25,000 to install and operate a local electric light and power system. The company is headed by S. F. Bond and T. C. Cross.

Hallettsville, Tex.—The Common Council is arranging for a bond issue of $20,000 for improvements in the municipal electric plant and waterworks, operated in conjunction.

WESTERN STATES.

Los Angeles, Cal.—William Mulholland, chief engineer of the Water Bureau, and R. F. Scattergood, chief engineer of the Bureau of Power and Light, have recently returned from an extended inspection trip which included the mountain water-shed section of the state around the Owens river development sites. The city has under way the initial construction work on three new power plants along the Owens river gorge, the three new plants now being planned to be located nearly 250 mi. distant from the city. The first to be constructed will probably be situated along the Owens river gorge in the Crooked creek district, the other two probably will be constructed within a radius of 15 mi. of the first, it is reported.

Juneau, Alaska.—J. H. Cann, Box 261, has applied to the Federal Power Commission for a license to construct a small diversion dam in Cann creek at the middle power site; pipe line 1000 ft. to 75-hp. air compressor, at the head of Lisianski Inlet, Alaska, to be used for power for mining.

CANADA.

Camrose, Alberta. — The Town Council plans to make additions and extensions in the municipal powerhouse and install new equipment, the estimated cost of the work being $20,000. Address town clerk.

Peace River, Alberta—The Town Council plans to erect electric light plant and system at an estimated cost of $250,000. Address town clerk.

INCORPORATIONS.

Pittsburgh, Pa.—Model Electric Manufacturing Co. Capital, $25,000. To manufacture electrical products. T. H. Heuber, 1104 Bushton avenue, treasurer.

Philadelphia, Pa.—Electric Sun Co. Capital, $50,000. To manufacture electrical operating displays. A. V. R. Barringer, Jr., 1705 Mount Vernon street, treasurer.

Indiana Harbor, Ind.—Burns-Pollock Electric Manufacturing Co. Capital, $1,000,000. To manufacture electrical equipment, appliances, etc. Incorporators: A. J. Burns, Thomas Pollock and Arthur Jennette.

New York, N. Y.—John Jergensen Co. Capital $50,000. To manufacture electrical appliances. Incorporators: John Jergensen, M. F. Sticht and H. A. Kapit. The company is represented by Sapinsky & Amster, 276 Fifth avenue.

New York, N. Y.—Pignolit Instrument Co. Capital $20,000. To manufacture wireless equipment. Incorporators: L. M. Pignolit, W. F. & C. A. Hessel. The company is represented by Straley & Hasbrouck, 257 Broadway.

Hoboken, N. J.—Thomas Brown Co. Capital $45,000. To manufacture electrical machinery. Incorporators: Thomas Brown, Weehawken; Myron Abrams and E. Lambert.

Ampere, N. J.—E. M. F. Electric Co., 196 North 15th street, has filed notice of organization to manufacture and deal in electrical specialties. William Henderson heads the company.

Pittsburgh, Pa.—Reliance Boiler Works are being organized by William Oleon, Raymond M. Collins and David Turets, 501 Bakewell building, to manufacture boilers and kindred equipment. Application for a state charter will be made July 18.

Wilmington, Del.—Oriental Electric Fixture Co. Capital $50,000. To manufacture lighting fixtures. Local incorporators: M. E. and Franklin Mettler and P. M. Gilkey.

Boston, Mass.—Hood Turbine Co. Capital $100,000. To manufacture turbines and electric power equipment. Incorporators: Robert J. Hurley, Walter H. Smart and Curtis D. Chase.

FOREIGN TRADE.

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Accessories (35,100)—An engineering firm in British East Africa requests catalogs of self-contained lighting sets, centrifugal pumps, electrical accessories, windlasses and disintegrators.

Washing Machines (35,094)—A mercantile company in Canada desires to purchase washing machines. Quotations should be given f. o. b. port of shipment. Cash to be paid. References.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Capitalization Readjustment Proposed by North American Co.

The North American Co. has sent a letter to stockholders proposing a readjustment of its capitalization. The plan calls for authorization of $30,000,000 of 6% cumulative preferred stock, redeemable at 105, and $30,000,000 of common stock, both of $50 par value. The present authorized capital stock is $30,000,000, of which $29,793,300 is issued. Under the plan it is proposed to exchange for the present holdings one-half in preferred stock and one-half in common.

Bond Offering of Rochester Gas & Electric Corp.

An issue of $7,000,000 Rochester Gas & Electric Corp. general mortgage 25-yr. 7% bonds is being offered by a syndicate headed by J. P. Morgan & Co., at 96, to yield approximately 7.35%.

Anaconda Copper Mining Co. Bonds to Be Redeemed.

Holders of Anaconda Copper Mining Co. 10% secured series "A" 6% and series "B" 7% gold bonds, due Jan. 1, 1929, have received notice that $750,000 of the notes will be redeemed Aug. 30 under operation of the sinking fund on a 6% basis.

Southern Utilities Co.

	1921.	1920.
April gross	$ 267,978	$ 231,404
Net after taxes	62,185	38,718
Total income	443,397	22,124
12 mo. gross	2,807,451	2,274,629
Net after taxes	537,733	414,469
Total income	312,466	214,788

Idaho Power Co.

	1921.	1920.
April gross	$ 158,138	$ 173,114
Net after taxes	68,027	85,248
Total income	88,390	91,830
12 mo. gross	2,336,108	1,945,908
Net after taxes	1,188,333	963,443
Total income	1,335,832	1,037,963

Duquesne Light Co. and Subsidiary.

	1921.	1920.
May gross	$1,301,904	$1,098,973
Net after taxes	430,459	261,669
5 mo. gross	7,062,257	6,080,740
Net after taxes	2,527,147	1,976,167

Detroit Edison Co.

For May—	1921.	1920.
Gross revenue	$1,751,889	$1,669,922
Net income	393,474	291,022
Surplus after interest	108,886	100,757
For 5 mo. ended May 31:		
Gross revenue	9,896,183	8,701,199
Net income	2,659,344	1,938,624
Surplus after interest	1,296,859	1,054,111

Alabama Power Co.

	1921.	1920.
May gross	$ 365,258	$ 333,449
Net after taxes	201,099	170,094
12 mo. gross	4,456,934	3,419,264
Net after taxes	2,251,578	1,831,352

Northern Ohio Electric Corp.

	1921.	1920.
May gross	$ 626,355	$1,009,513
Net after taxes	158,878	240,883
Surplus after charges	10,129	106,346
5 mo. gross	3,717,378	4,705,142
Net after taxes	785,827	1,319,903
Surplus after charges	30,248	667,535

Puget Sound Power & Light Co.

	1921.	1920.
May gross	$ 799,785	$ 789,833
Net earnings	283,885	337,070
Surplus after charges	141,776	186,199
12 mo. gross	10,186,901	9,413,757
Net earnings	4,256,570	3,814,824
Surplus after charges	2,373,882	1,998,358

Commonwealth Edison Bonds Sold to Banking Syndicate.

The Commonwealth Edison Co., Chicago, has completed arrangements for the sale of $6,000,000 first 6% bonds to a syndicate of 20 banking institutions. The bonds will run 22 yrs. and will be offered to the public at 91.5 and interest, yielding about 6.75%.

Southern California Edison Co.

Month of May.	1921.	1920.
Gross earnings	$1,508,277.76	$1,190,532.13
Expenses and taxes	556,823.91	436,589.88
Net earnings	951,453.85	753,942.25
Fixed charges	347,400.87	256,433.34
Balance	604,052.98	497,508.91
12 mo. ending May 31. 1921.		
Gross earnings	16,147,535.72	11,430,785.03
Expenses and taxes	6,857,400.63	5,078,235.27
Net earnings	9,290,135.09	6,352,549.76
Fixed charges	3,344,103.94	3,040,435.40
Balance	5,946,031.15	3,312,114.36

Appalachian Power Co.

	1921.	1920.
May gross	$ 205,036	$ 153,851
Net after taxes	86,061	59,396
Total income	87,227	59,396
Surplus after interest charges	31,189	6,107
Balance after preferred dividends	3,030	*8,973
12 mo. gross	2,464,152	1,805,012
Net after taxes	1,093,371	809,578
Total income	1,100,370	809,578
Surplus after interest charges	427,918	189,396
Balance after preferred dividends	123,452	*22,408

*Deficit.

Galveston-Houston Electric Co.

	1921.	1920.
May gross	$ 318,013	$ 334,843
Net earnings	84,694	104,950
Surplus after charges	48,944	69,644
12 mo. ending May 31:		
12 mo. gross	3,931,326	3,315,950
Net earnings	1,129,305	884,761
Surplus after charges	705,431	462,421

Southwestern Power & Light Co.'s Subsidiary

	1921.	1920.
May gross	$ 790,598	$ 700,686
Net earnings	318,196	265,484
12 mo. gross	10,398,364	7,411,179
Net earnings	3,723,553	2,959,243

American Power & Light Co.'s Subsidiaries.

	1921.	1920.
May gross	$1,957,013	$1,641,315
Net earnings	671,866	578,691
12 mo. gross	23,992,814	18,091,649
Net earnings	7,845,050	6,902,888

Adirondack Power & Light Corp.

	1921.	1920.
May gross	$ 369,353	$ 364,450
Net after taxes	127,851	158,736
12 mo. gross	4,805,492	4,072,972
Net after taxes	1,385,457	1,359,130

Dividends.

	Term.	Rate.	Payable.
American Lt. & Tr., com.	Q	1%	Aug. 1
American Lt. & Tr., com. stk.		1%	Aug. 1
American Lt. & Tr., pfd.	Q	1.5%	Aug. 1
Can. Gen. El., com. stk.		2%	Aug. 1
Car. Pr. & Lt., com.	Q	0.5%	Aug. 1
Elec. Stor. Bat., com.	Q	$3	Oct. 1
Elec. Stor. Bat., pfd.	Q	$3	Oct. 1
Mountain States Pr., pfd.	Q	1.5%	July 20
Pub. Serv. of Nor. Ill., com.	Q	$1.75	Aug. 1
Pub. Serv. of Nor. Ill., pfd.	Q	$1.50	Aug. 1
Ry. & Lt. Securities, com.	SA	$3	Aug. 1
Ry. & Lt. Securities, pfd.	SA	$3	Aug. 1
San Diego Cons. G. & El., pfd.	Q	1.75%	July 15
Western States G. & El., pfd.	Q	1.75%	July 15

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid July 2.	Bid July 11.
Adirondack Electric Power of Glens Falls, common	6	9	9
Adirondack Electric Power of Glens Falls, preferred	6	71	70
American Gas & Electric of New York, common	..	98	99
American Gas & Electric of New York, preferred	6	36½	35½
American Light & Traction of New York, common	..	75½	79
American Light & Traction of New York, preferred	6	78	77
American Power & Light of New York, common	4	53	52
American Power & Light of New York, preferred	6	65	64
American Public Utilities of Grand Rapids, common	..	8	8
American Public Utilities of Grand Rapids, preferred	7	17	18
American Telephone & Telegraph of New York	..	102	103
American Water Works & Elec. of New York, common	..	4	4
American Water Works & Elec. of New York, particip	7	8½	8½
American Water Works & Elec. of New York, 1st preferred	..	49½	47½
Appalachian Power, common	..	4	4
Appalachian Power, preferred	7	28	28
Cities Service of New York, common	+extra	115	114
Cities Service of New York, preferred	6	42	41
Commonwealth Edison of Chicago	8	108	108
Comm. Power, Railway & Light of Jackson, common	..	9	9
Comm. Power, Railway & Light of Jackson, preferred	6	28	28
Federal Light & Traction of New York, common	..	6	6
Federal Light & Traction of New York, preferred	..	42	41
Northern States Power of Chicago, common	..	44	44
Northern States Power of Chicago, preferred	ex.div. 7	78	78
Pacific Gas & Electric of San Francisco, common	..	52	53
Public Service of Northern Illinois, Chicago, common	7	76	78
Public Service of Northern Illinois, Chicago, preferred	6	77	80
Standard Gas & Electric of Chicago, common	..	9½	9
Standard Gas & Electric of Chicago, preferred	8	33	31½
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	4½	4
Western Power of San Francisco, common	..	23	23
Western Union Telegraph of New York	..	87	86¼
Industrials—			
General Electric of Schenectady	8	128	127½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	43½	44